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EDITORIAL NOTES.

The New Year.

WE stand at the opening of a New Year in circumstances momentous and unprecedented. Never in history has there been a time when the wish could be more fervently expressed than now, and its consummation more devoutly hoped for, that the New Year may be a happier one nationally and for each individual than the last. This greater happiness can only be attained this year (which has begun with fresh tragic and inhumanly devised incidents) through the delivery of the world, in the complete way that this country and its gallant Allies desire, from the blasting influences of the sanguinary and destructive war. The clash of huge forces has been proceeding now (within about three weeks) for a year and a half; and no one can say how long it will be continued, although confidence reigns that organization, courage, and resolve have placed us on the high road to victory and enduring peace. We all earnestly trust the confidence is not misplaced. Great are the sacrifices that have been made; and great have been the claims upon all. And no one knows what may be the demands in the way of sacrifice that will yet be made. In these sacrifices, the gas industry has shared in common with others; in the unknown sacrifices lying before, the industry will also have to share. The greater they are, the more the industry will suffer financially through its trading. It is an industry that is largely dependent upon the prosperity of other industries and of the nation as a whole. We are constantly speaking of our prime commodity as a "necessary" of life. So it is. But if the prosperity of the country wanes, or if any extraordinary demands are made on the profits of the country's prosperity, then necessaries cannot escape the attacks of a compulsory economy. The war has schooled us to the facing of unique conditions with good resolution; and the industry will so continue to face them. But the war has done something else for our industry. It has given us new experiences, and new lessons. And these experiences and lessons must be imported into the future, and serve to direct and control future operations. From them are seen the ways to greater expansion and consolidation. The industry has used its great vitality and adaptability to shaping its course in manner compatible with the new and extraordinary conditions; and, in so doing, the imits of effective service are pushed further out. For many years the industry has been extending the territory of its service; and, in the past seventeen months, new and unexpected territory has been added within which the industry has been called upon to operate. The burden of war lies heavily upon the industry in the present in common with the rest of the country; but beyond we see the enlightenment hat has come from national adversity brought to bear to the ndustry's lasting benefit. May the day be hastened, when, by the cessation of hostilities through positive victory, the ndustry may set to work upon the task of restoring its conditions and fortunes, and making use of its new opportunities. If, fortunately, this event is embraced by the year upon which we have now entered, the note of our New Year's greeting twelve months hence will be pitched in a happier key.

The Manifold Uses of Gas for Munition Making.

AN article which will at once inspire and be a source of ncouragement and gratification, appears in other columns under the title of "Some Uses of Gas in the War." We ave previously, through other channels, had some indication as to the large part that gas is taking in the actual roduction of munitions, quite apart from the supply of the ital ingredients with which certain of the munitions are ed. But in the present article, we are given—utilizing the Essex Works of Messrs. John Wright and Co., of Birmingham, as the ground of investigation—"a peep behind the "scenes," in order to see the multifarious character of the work that is being executed by the assistance of gas in the country's munitions factories. From this, there is to be derived, as we have just expressed it, a large amount of encouragement and gratification by those employed in the gas industry, because it shows that, if, under the exigencies of war requirements, the application of gas to all heating purposes for the production of munitions results in saving of space, in increased output, in enhancing control and uniformity of production, in eliminating waste, in promoting output in relation to works and labour, and in increasing works' efficiency and therefore economy, then this large group of advantages will obtain equally in times of the normal pursuit of industry and trade. But the more we penetrate into the remarkable application of gas to munitions work (no other form of heating could have been introduced so quickly), the more we feel that considerable acknowledgment is due to the makers of gas-heated furnaces and other heating equipment for the way in which they have met the extraordinary needs of the country. We pride ourselves in the gas-supply industry that it is, as a whole, working wondrously well in supplying the gas for war products and the necessaries for the making of explosives; but the manufacturers of these gas-heated appliances, large and small, for dealing with anything from brass buttons up to 15-inch shells, and even larger and weightier "articles" than these, have done their part in a manner that is beyond all praise. They stood at the entrance, so to speak, to a large part of this munitions work; and the gas suppliers and the munition workers had, on the scale at which work is now being pursued, to wait the issue of their endeavours. Output in relation to time meant much in this connection; and one cannot but be struck with what was accomplished in brief time in face of the shortage of labour and materials, and the indifferent facilities for transit. It was an immense task, which, apart from the commercial profit, was well and patriotically carried through, with, we are confident, lasting advantage to both the manufacturers of such appliances and the gas-supply industry generally. While this work has been proceeding, the manufacturers have also managed somehow—more, we believe, by excellent organization and method, than by any facilitating or adventitious conditions—to keep pace with the requirements of the gas industry for other and more ordinary goods.

Incorporated in the article are extracts from an official communication from the Director of Factory Construction in the Ministry of Munitions to the manager of every munitions factory in the country. We have before spoken of the need that there is for co-ordinating the work of the various departments engaged upon organization and provisioning for the war, as there has been abundant evidence of the counteractive effect that the prescripts and demands of one department sometimes have on the work of another. There has recently been disclosure, too, of the fact that there has not been much reciprocity shown by the Government in relation to the compliance of the gas industry with their requirements for certain supplies indispensable and really vital to the war. The official communication from the Director of Factory Construction, however, indicates that, at all events, at the Ministry of Munitions it is appreciated that, in these matters, there is interdependence and mutuality which ought to be and must be studied. Toluol, benzol, and other materials having properties essential to the manufacture of explosives are wanted in the largest possible volume; the largest possible volume cannot be obtained without the largest possible quantity of gas that can be serviceably used is consumed; and the consumption of this largest possible quantity of gas will not be attained without every munition factory putting to the utmost employment gas for the quadruple purposes of lighting, heating, cooking, and power. It is the recommendation of the Director of

Factories that this should be done; and it is being done to a very considerable extent, so much so that, in one city at any rate, the demand has been highly embarrassing. Such factories are working long hours, artificial lighting is required; they employ operatives in great number, means for cooking and warming food are required; for work, personal cleanliness, and in connection with the culinary operations, hot water is required; and in a thousand-and-one processes in connection with munitions work, heat and power are required. The opportunities for putting gas to good and advantageous use in such places are therefore great; and the more the opportunities are recognized, and recognition is followed by action, proportionately larger will become the country's resources for toluol, benzol, xylol, and other necessaries. We are pleased to observe the strong recommendation of the Director of Factories; seeing that one of the sources of material strength is the organization of work so that it is enabled to supplement national resources in respect of national essentials.

Some of the photographic reproductions accompanying the article in other columns are unique, for they have actually been taken, by permission, in factories devoted to munitions work, and they illustrate a considerable range of processes and sizes of plant in which gas is being used for supplying the needs of our Army and Navy, and of the workers in the factories. The second illustration is quite novel, as it graphically shows that in the making of a single shell—what an expenditure of shells there is day by day!—gas is required in a dozen and more of the processes contributory to the perfected article. The interest we have derived from the largely extended department at the Essex Works, Birmingham, which has been specially devoted to productions for munition work, will, we are sure, be generally shared, through the reading of the article and the study of the illustrations, by those engaged in the work of supplying the gaseous fuel for use in the types of plant referred to, and which, needless to say, are only representative, and not comprehensive, of the whole of those employed in the variegated work.

The Other Side of the Pooling Question.

The question of the pooling of privately owned railway waggons is, to all outward appearances, in abeyance at the moment; but what is happening behind doors one cannot say. There is, however, the word of Mr. Runciman that nothing shall be done in the matter without consulting the owners, who are naturally much opposed to being deprived, in meeting their obligations, of the facilities and economies with which enterprise and forethought have provided them. Mr. R. P. Wilson, in an article given in the "Iron and Coal "Trades Review," puts forward the contrary view. If we understand him rightly, there are times in which everybody should become severely altruistic, and think only of the common good, which is all very well up to a point. It is a pity that the coalowners and shipowners did not so think from the beginning of the war. But the fact stands out boldly and undeniably that they did not; and the country has since suffered very acutely from their profit-making proclivities. However, Mr. Wilson does not address himself to this aspect of the case; he confines what he has to say wholly to the one and only subject of the pooling of railway waggons. He starts on his argument with the contention that a properly organized system of pooling would go nearly the whole way towards solving the question of congestion on the railways, and winds up by saying that, if the waggons available were used to the best advantage, they would be more than ample for requirements. Therefore during the writing of the article Mr. Wilson's convictions expanded to such an extent that the capacity of the available waggons for solving the congestion problem grew from "nearly the whole way" to "more than ample." This attests an indefiniteness in the matter of data. Then this advocate of pooling says it must be remembered that trucks are primarily owned and used as a facility, and should be regarded in that light rather than as an investment. We cannot endorse this proposition as nakedly stated. The facility the trucks provide is only obtained by enterprise and investment; and the ownership acquired by investment is intended to be, and is in fact, an economic advantage which produces profit for the owners.

We come to the main point of the article, which is that the scarcity of trucks is not due to actual insufficiency, but to their terribly inadequate running. In other words, it is submitted that there is great waste of time and carrying power in the present unsystematic running, shunting, marshalling, and sorting of trucks, which, under a system of pooling, would not obtain. And what is suggested is that, when trucks, from the owner's colliery or works, reach their destination, they should then be despatched to the nearest colliery or works requiring them, or be utilized for taking goods from the point of destination to some other part, and so, by continuous oversight, and planning to make supply meet demand, utilizing to the fullest extent the carrying capacity, instead of running return trucks empty many miles during a year. In theory, this looks all right. But vast machinery would have to be set up to carry on such an organized control of traffic all over the country, and to ensure that no one quarter of the country was more favoured in the matter of distribution than another, consistent with requirement. We can see that collieries, for instance, situated near the large centres might, under Mr. Wilson's scheme, benefit greatly at the expense of collieries situated farther away, which might before the advent of the pooling arrangement have been the happy possessors of a large number of trucks, bought purposely to fully satisfy their needs, and to clothe them with greater competitive competence in view of their comparatively inferior geographical situation. The same argument applies to gas or other waggon-owning undertakings. Of course, no one can deny, when (say) gas-works owned waggons are sent back empty to a colliery for a further supply of coal, that from works to colliery there is a waste of carrying capacity; and there appears to be no reason why—if goods could be carried to towns on the line to the colliery, and providing there is not much delay—use should not to that extent be made of the waggons as a contribution in these times to the relief of what is conceded to be a very serious position. But it seems to be for private owners a very hard proposal, and one which would have for them serious effects, that the very trucks which they have provided to raise the levels of efficiency and economy, and to enable them to better meet their obligations, should be scattered all over the country without let or hindrance on their part. The pooling scheme, in short, diverts the waggons from their original object to benefit those who have not been equally, or sufficiently, prudent.

However, while Mr. Wilson asserts that, under a properly organized pooling scheme, there would be, including the railway companies' trucks, an amplitude of carrying power, he says that no doubt there would be hardships. But, if his theory is right, if he is correct in saying there would be ample trucks for all purposes and requirements, there ought not to be any hardships whatever. The fact of the matter is that the talk in favour of a pooling scheme is distinctly vague; and what those interested want to see is something more concrete in the nature of a scheme, as well as the character of the mechanism that would be brought into use to cause everything to work out with the beautiful precision that would produce an actual excess of carrying power in the country. Until scheme and operating mechanism are presented for consideration, we must lean towards the opinion that serious injustice would be done by depriving, in the hours of their greatest need, private owners of something of which they had providently become possessed.

Dr. Fleming on Electric Cooking and Water Heating.

In dealing comparatively with gas and electric cooking and heating, it is the wont of our electrical friends to talk mainly about what is called the thermal efficiency of gas-ovens and boiling-rings and their electrical equivalents. And we get various percentages mentioned by them for electric and gas types of appliances. The efficiency of the electric type may be variously stated at anything between 95 and 65 per cent., and much lower for water heating on boiling discs; while with gas anything between 45 per cent. and almost vanishing point is quoted as the percentage. "There you "are," says the electrician—who, if of anything, is a past-master of postulation—"the efficiencies of electric cookers "and water-heaters are higher than those of gas appliances." Efficiency—dealing with different heating agents, and with thermal energy supplied by them at different costs—is not the sum of the question. There are a good many other factors to be taken into account. Professor J. A. Fleming has recently, at University College, been complimenting the electric industry on the heating "efficiency" of their cooking and warming appliances, but not of much else. Of course, a high efficiency means that the margin for further improvement is small; and if, in relation to a lower efficiency appliance, the cost of operation is about the same—perhaps greater—the prospects are that, with the good field for attaining a higher efficiency, and the equally good chance of the price of the heating commodity being reduced, the lower efficiency appliance will, on the score of running cost alone, without any other considerations—such as low initial, maintenance, and renewal costs, as well as reliability—take some shifting out, and will maintain its supremacy of adoption.

Professor Fleming, however, told his audience that for cooking purposes he considered that electricity at 1d. per unit was practically equivalent to gas at 2s. 8d. per 1000 cubic feet, which is absurd. When he speaks thus, he has to account for the difference between above 15,500 B.Th.U. and 3420 B.Th.U. procurable for a penny from respectively gas and electricity. On his statement, with gas more than 12,000 B.Th.U. are dissipated in getting accomplished the work realized by the expenditure of 3420 B.Th.U. electrically produced. And yet what do we find? That though the margin of efficiency in the case of electric appliances is so narrow for improvement, the Professor himself has to confess that the already low rates charged for current for cooking and heating are, under normal conditions sufficiently high, and they do not allow of increases ranging from 15 to 25 per cent., such as have been necessary in these war times. When these conditions as to efficiency and yet the necessity for a low price are examined attentively, the Professor's admission is found to be a very grave one—so very grave that the commercial man of the "Electrician" says: "Having regard to all the circumstances, we cannot but "agree with Dr. Fleming in his criticism." Having regard to "all" the circumstances. It is, indeed, very rarely that one gets an electrical writer to have regard to "all" the circumstances at once—he generally looks at them individually, as collectively they are apt to be overpowering.

There is another thing Professor Fleming has overlooked. His calculations regarding electric cooking and heating are apparently based on personal laboratory investigation, while it is pretty certain that several of the figures applying to gas are more or less hypothetical and apocryphal. Of course, the carefully guarded work of the laboratory cannot be transferred to the kitchen, as those central station engineers only too well know who have had experience with the electric cooking business. If Professor Fleming would only do men engaged in the practical management of the commercial business of the central station the honour of paying attention to what they have said at the meetings of the Institution of Electrical Engineers, at sectional meetings of the Institution, and at meetings of the Incorporated Municipal Electrical Association, and at meetings of the "Point-Fives" Association, he would find that it is very generally admitted that the conventional modes of the kitchen do not subscribe to refinement and to the most economical working. And a professor or a central station engineer, or other electrical expert, cannot be told off to be always supervising work in the kitchen, so as to secure the maximum economy under electrical conditions.

However, the eminent lecturer did make an admission derogatory of electrical operation. He confessed that, owing to the high specific heat of water, its electric heating was a very costly matter. And yet he pointed out that whereas the efficiency of the gas boiling-ring in heating water was only 58·6 per cent., that of an electric kettle—that is to say, a kettle with the heating element an integral part of it—is 90 per cent. But even if this high efficiency be accepted, the electric-kettle cannot do better than supply 2 pints of boiling water in a quarter of an hour, using current at the rate of ½ kilowatt per hour—or ⅛ unit for the heating of the 2 pints of water. If one calculates out the B.Th.U. absorbed in the operation of heating to boiling point the two pints of water, it will be found that Professor Fleming has taken 100 per cent. efficiency, and the full heating value of the ⅛ unit, and so has found that 2 pints of water, starting (say) at 50° Fahr., will be raised to 212° Fahr. by expending 427 B.Th.U.—almost the exact number of degrees Fahrenheit that the 2½ lbs. of water have to be raised in temperature. This has not allowed for any heat losses. If this is the manner in which other of the Professor's figures have been calculated out, then we are unable to place upon them very much reliance. Using an electric heating element separate from the kettle or other vessel to be heated, the waste is immense, and efficiency low, and, of course, the Professor has taken the best possible conditions. Even under such conditions, he finds that electrical energy would have to be supplied at $\frac{1}{20}$d. per unit to compete with coal at 20s. per ton. But he makes the remark (which is the remark of ignorance) that the heating of water plays a minor part in cooking operations. Cooking experts tell us that—including all boiling operations—about 75 per cent. of the cooking work is done on the top-plate of a gas-cooker. Of course, however eminent a professor may be, he cannot be expected to know everything about cooking; and this accounts for certain of his statements being somewhat wide of the mark, and for some of his theoretical calculations being altogether opposed to practice.

Leeds University Lectures.

The special lectures which Professor John W. Cobb, B.Sc., F.I.C., has arranged for this year in connection with the Department of Coal Gas and Fuel Industries (with Metallurgy) at the Leeds University, are set forth in the programme which appears on another page of this issue; but there are some points about the programme to which attention may be drawn here. It will be noticed, in the first place, that on the present occasion Dr. Harold G. Colman's course on "Gas Manufacture" has not been arranged for; its omission being due to the circumstances which just now must govern the engagements of both lecturers and students. As a matter of fact, in regard to those courses which are on the programme, it has been necessary to insert a proviso reserving to the University the right to cancel them, as it is recognized that the numbers of students able to attend may well be too small to justify the giving of the lectures; while there is also the possibility that such time as the lecturers still have available may be taken up by national work. Though, however, for reasons which will be apparent, conditions are adverse to comparatively long courses, Professor Cobb's experience arising out of the tar-testing work in hand convinces him that some short courses can be usefully given. He is at present engaged in testing tars from gas-works in Yorkshire and Lincolnshire for toluene and benzene, and oils in which these constituents have been absorbed from gas; and he is of opinion that a short laboratory course which would put gas-works people in a position to make tests for themselves, as often as they wished, and on as many samples as they desired, should be of service, and might have some effect in increasing the efficiency of the extraction processes. The short lecture course on coal and carbonizing is aimed at providing a summary of the fundamentals of the subject, and also at presenting what is known as to the influence of carbonizing conditions on bye-products—especially benzene and toluene. As to the work in the laboratories of the Department, it is not surprising to learn that the times are busy. Nearly all Professor Cobb's own students went at the beginning of the war; and when the tar-testing work came along, he had to draw on Professor Smithells for men, who worked at it through the long vacation, and some of them have gone on ever since. In fact, Professor Cobb refers in high terms to the zeal and efficiency of his helpers—especially his assistant lecturer, Mr. Hodsman. The ventilation research is, it may be added, being proceeded with by Mr. W. Harrison.

Gas-Fires and Electric-Radiators.

We were pleased to receive from Professor A. H. Barker, of University College, the letter which appeared in last week's issue regarding the above subject, though the pleasure need not be taken as an endorsement of all the points presented in the communication. There is regret that the comments in our previous issue were based upon a misreported passage in an electrical contemporary; but the regret is mitigated by the fact that the comment has brought from Professor Barker a very necessary correction. The effect of what he said was that the manufacturers of gas-fires had devoted so much attention to the improvement of "radiant efficiency" that the air of a room may be insufficiently warmed, although the radiant temperature may be so high as to scorch the knees of a person sitting 4 feet away from it. "There was nothing about the glowing fire-clay being too hot." This is an altogether different story from that published by the electrical contemporary which gave circulation to the statement that called for our comment. Touching the correction, it is noticed that Professor Barker regards the application of the term "efficiency" in connection with heating as being altogether out of place; and he believes that all the householder cares about is the commercial question as to what it will cost to comfortably heat a room under given conditions. This being so, we may look at our correspondent's contention from the practical point of view. We have had a very large experience of modern gas-fires—in fact, gas-fires of many types have been in use by us for the past quarter of a century. With modern gas-fires, we have never had any difficulty in obtaining just what is required for warming a room to a comfortable temperature; and we have not noticed the scorching of our trousers, or of our hearthrugs, or of anything that is within customary proximity to the gas-fires. The gas industry has a very extensive, and not a narrow, experience of gas-fires.

Cost and Efficiency.

No doubt Professor Barker is right as to the commercial consideration applied by the user in connection with means of heating; but consideration applied by the user is not the only commercial one. Others who have to apply commercial considerations are those who come between the manufacturers and the user—such as gas undertakings in the case of gas-fires; and, in making their purchases, they must have some standard by which to adjudge the relative values of fires. They cannot before purchasing fires test them under the thousand-and-one unknown conditions under which they will be used; and therefore the gas industry has adopted the practical standard supplied by ascertaining the efficiency of fires, by means designed and approved by scientific men, and under definite conditions, by measuring radiant heat, ascertaining the amount of heat passing away by the chimney, and placing the difference to the credit of convected heat, and expressing the result in terms of the percentage of the calorific value of the gas consumed, as tested by methods prescribed by the Metropolitan Gas Referees. Professor Barker has no doubt studied all the work that has been done in this connection; and, if he has, he must admit that the science of measuring the heat-emitting capacities of gas-fires has been carried beyond any like work that has been done in any other direction. We must also for the purpose of technical discussion have standards upon which questions affecting heating values can be spoken of relatively. Under the circumstances of the means of testing gas-fires that have been made available by research, and of the fact that men of high reputation in the scientific world have put the heating capacities of modern gas-fires under proper scientific test, and have given us the results, the gas industry is enabled to make authoritative statements, and to find much that is "entertaining" in the stupid statements that are made by electrical competitors concerning their rival. The origin of these statements is enveloped in mystery, and certainly cannot be supported by the best of available scientific means of testing the thermal efficiencies of methods of heating.

Some Rating Statistics.

Those who have been in the habit of looking forward to the annual compilation of statistics with regard to rating, gas, water, and electricity charges, and municipal trading profits and losses, which for a very long time was published towards the end of each year by Mr. James Carter, the Borough Treasurer of Preston, will be glad to see from to-day's issue that though Mr. Carter is unfortunately no longer with us, the work of preparing the statistics has been continued by his successor at Preston—Mr. W. Allison Davies. The last issue edited by Mr. Carter was the thirtieth of the series; and though the particulars furnished year by year were the same, the number of towns with regard to which this information was vouchsafed, on almost every occasion showed an increase over its predecessors. By the issue of the thirtieth statement, the list of towns included had grown to 134; and this year Mr. Davies has improved on previous records by bringing the total up to 137. The additions are of towns on the small side so far as population is concerned; so that their inclusion will serve to make the figures even more thoroughly representative than has hitherto been the case.

What the Figures Show.

Glancing at the present returns and comparing the statistics (which are for 1915-16) with those of a year ago, it would seem that in the interval there has been a fairly-well developed tendency for the rates to rise; for of the towns mentioned there are 42 in which the rates amount to 9s. or more in the pound, as against only 24 in 1914-15. In two cases the amount is over 11s. —Norwich 11s. 6d., and East Ham 11s. 1d. There are a good many towns—ten, to be precise—in which, though the rates do not reach 11s., they are still over 10s. in the pound. This is a somewhat significant fact, in connection with the present call for economy in every direction. On the last occasion, there were three towns in which the rates were 5s. or less in the pound; but this time there are only two—Blackpool and Oxford. The table showing the charges made for gas for domestic lighting, bears evidence, of course, of a very general increase. A year ago, in 28 of the places included, the charge was 2s. or less per 1000 cubic feet, as compared with 31 for the year before that. Now, the number is only seven—Widnes being easily lowest, with Sheffield and Sunderland making a tie for second place. Another sign of the times is that in but nine instances have the rates of the towns referred to been relieved from remunerative undertakings to the extent of 1s. or more in the pound, a figure which compares with 17 a year ago, and 19 for the year before that. On the other hand, there were 67 cases in which deficiencies incurred in connection with such undertakings had to be met out of the rates. In most places, however, the sums were comparatively small; there being only ten figures mentioned which are over 10d. in the pound. Ten cases of deficiency occur in connection with electric light undertakings—some of them substantial.

Control of Exhibitions.

A significant intimation is being made by the Board of Trade, who call attention to provisions of the Defence of the Realm Regulations empowering the Minister of Munitions, after consultation with the Board, to prohibit, or impose restrictions on the holding of, industrial exhibitions and fairs during the war, in order to prevent the production of war material being prejudicially affected. It is to obviate so undesirable a result that the forthcoming British Industries Fair, referred to in last week's issue [which is being promoted by the Board of Trade], will be confined to exhibits of china and earthenware, glass, fancy goods, toys, games, stationery, and printing. As a further precaution, however, it is stipulated that any firm who hold contracts for a Government Department will have to obtain the permission of the Department before exhibiting. The point to be borne in mind is the statement of the Board that it is proposed to impose similar restrictions on the holders of any other industrial exhibitions and fairs. In the regulations under which this action is taken, it is ordered that any person intending to hold an exhibition or fair of the kind referred to—namely, one the exhibits whereat "consist in whole or in part of the products of any industrial or manufacturing process, or the machines, tools, and implements used for the purpose of any such process"—shall, at least one month before the date fixed for the opening, give to the Minister of Munitions notice in writing of his intention, together with such particulars as the Minister may require. Failure to comply, will constitute an offence against the regulations.

A Black List of Enemy Traders.

The Government have taken steps, by extending legislation, to do something towards stopping the trading in this country with goods of enemy origin. The gas industry has had experience of this form of trading; and we have urged that the most scrupulous care should be exercised by gas undertakings and wholesale houses to see that there is no contribution of support to the enemy by participating in such traffic. One course the Government are proposing to take is to compile a black list of traders in neutral countries, who, whether of enemy nationality or not, are substantially enemy firms who can be safely cut off from British intercourse without doing serious injury to British trade. If such a list is prepared with Government authority, we hope that it will be given the widest possible circulation, through, so far as they are concerned, the various trade papers. In the House of Commons, the hope has been expressed that the list may include firms operating not only from European neutral countries but from countries further afield. It is known that even in South America there are firms of enemy formation doing business with this country, whose money is being used to assist the enemy, and the kith and kin of the principals of which firms are fighting against this country and its Allies. All such firms should be included in the black list; and so should the agencies in this country that further the interests of the firms. However, though it is felt that the

Government are not yet doing all they might do in this matter, there is gratification that they are making another move to stop the traffic. The Board of Trade have also warned importers that goods which originated in enemy countries, although they may have left enemy territory and become neutral property before the war, are liable to seizure under the Customs (War Profits) Act, 1915, if imported without the Board's permission. In connection with this Act, the Foreign Office has a department concerned with preventing trade by British firms and companies with the enemy in neutral countries; and now it has been decided to merge into it the Trading with the Enemy Department of the Home Office, which has the duty upon it of enforcing the measures already taken to prevent trading with the enemy, and the staff of which will continue to perform the same duties as members of the new department, in addition to taking part in the administration of the new Act.

Cyanamide and Granular Nitrolim.

The proceedings at the meeting of the Nitrogen Products and Carbide Company contained a large amount of promise, but little that is at present tangible for the shareholders. It can be quite appreciated that the working has been hampered, even in Norway and Sweden, by all sorts of problems and impediments brought about by the current disturbed conditions. Of course, while the Belgian property may be intact, it cannot contribute to the activities of the Company. But about the main operations, in one part of the speech of the Chairman (Mr. A. E. Burton), we read that difficulties are being "gradually" overcome, and in another part that they have been "largely" overcome, which shows that difficulties still exist. There is no information in the report as to whether these difficulties refer to those that were raised last year as to technical and heavy capitalization troubles, and patent rights. Regarding cyanamide, the shareholders were informed that considerable quantities had been sold for chemical purposes; and that contracts for 20,000 and 12,000 tons had been entered into for this year and larger amounts could have been sold in Norway had the Company not had to reserve a given amount for their new chemical works. The rest of the output, it was said, would hardly serve to meet the rapidly increasing demands of the growing industry for the fertilizers. The information was also given that the whole of the output of granular nitrolim had been sold for the coming season, and that more could have been disposed of to a considerably larger quantity had it been available. This granular nitrolim, in addition to nitrogen, provides a supply of lime and carbon; and so it is thought that in those parts of England where the soil is poor in lime content, this fertilizer will be specially suitable—in fact, it is said that the more it is used, the greater its popularity. Among other points, information was given that large works for the production of nitric acid and nitrate of ammonia by the catalytic process are in course of erection. Altogether, it is seen that the shareholders have still to live in the future, and to hope on.

Experiences at the Parliamentary Bar.

Last Sunday's "Observer" contained an interesting interview with Mr. J. H. Balfour Browne, K.C., who, as already intimated, is retiring after forty years' practice at the Parliamentary Bar, of which he has been leader for some years past. In the main, the interview consisted of personal reminiscences regarding the "giants of former days;" and Mr. Balfour Browne concluded what he had to say in the following terms: "In these forty years I have seen a great deal of Private Bill Legislation. Great railway schemes, although possibly not such speculative adventures as those of 1845, have been passed, and millions of money have been spent in the construction of the lines. Great water-works have been sanctioned and constructed, and important sewage schemes have been carried out. Electricity as an illuminant, and also in connection with the distribution of power, has come into existence in my time; and it has now become a huge accomplished fact. Electric traction, too, has begun to drive the steam locomotive to the British Museum. Tramways have spread their metal nets not only over our towns, but over inter-town territories, and, when 'out of town,' sometimes call themselves 'light railways.' The reminiscences of forty years' practice at the Parliamentary Bar are so many that it is well to put a strict turnstile to stop the crowd. I am perhaps under the glamour as to the calibre of the leaders of my early days, and under a similar glamour as to the Committees of the seventies and eighties; but I believe that the Commons Committees in those days were better than the Committees of more recent years. They certainly worked five days a week; while Committees of the Commons to-day for the most part only sit three days, and adjourn on Thursday night until the following Tuesday morning."

GAS BILLS FOR 1916.

[First Article.]

In noticing the Bills for promotion in the next session of Parliament, there will, with the comparatively few that have been lodged, be no attempt at classification, as is customary, as between company and municipal authority, or in any other way. There are exactly a dozen Bills dealing with gas, and two Board of Trade Gas Provisional Orders. There are also four Bills in which water undertakings are concerned—eighteen measures all told, which is about a record for a minimum number so far as memory carries us back.

The first Bill to be reviewed (taking them in alphabetical order) is that of the Aberdare and Aberaman Consumers' Gas Company. By the Company's Act of 1869, the original capital was fixed at £30,000, entitled to a dividend of 10 per cent. per annum. In 1874, authority was given to the raising of additional capital to an amount not exceeding in the whole £10,000, entitled to a dividend of 7 per cent. on the ordinary shares or stock, and not exceeding 6 per cent. on the part issued as preference. The whole of the original capital has now been issued; and the powers granted by the 1874 Act have been exercised by the issue of preference shares, bearing a dividend of 5 per cent. The powers to raise on mortgage or by debenture stock extend to £10,000; and there has been borrowed on mortgage £7500. The Company now ask for powers of conversion of the ordinary capital into stock on a 5 per cent. basis, and the conversion of the preference shares into stock. They also seek authorization to purchase by agreement the property of the Hirwain Gas and Coke Company, and for the extension of the limits of supply to include the areas served by the Hirwain Company. Capital and works powers are required; and repeal is sought of section 30 of the Act of 1869 which gave the Local Board of Health (now the District Council) power to purchase the undertaking at any time after the expiration of five years from the passing of the Act, on giving six months' notice in writing. These particulars are taken from the preamble. Turning for other details to the clauses, it is seen that, starting with the capital conversion provisions, it is proposed to convert the preference shares into one class of preference stock to the amount of £10,000 bearing 5 per cent. dividend. The ordinary shares, it is suggested, shall be converted into ordinary stock to the amount of £60,000, bearing a uniform rate of dividend of 5 per cent. The additional capital sought is £36,000. Appended to the clause (which is in the ordinary terms) as to the issue of the capital by auction or tender is the following:

> Provided that the foregoing provisions of this section shall not apply during the period of five years from the date of the passing of this Act, or within such longer period as the Board of Trade may by order in writing sanction, which said sanction the Board of Trade are hereby empowered to give, and the Directors may, during such period as aforesaid or such extended period, as regards any capital required for the purposes of the undertaking during such period, create and issue such capital at such price and on such terms and conditions as they may think fit.

Provision is also made for the issue of redeemable preference stock or debenture stock, and for the creation of a redemption fund. The total of the Company's borrowing powers is proposed at £38,000; but [this follows the Ascot Act of last session in departing from the one-third proportion] "no sum shall be borrowed by the Company in excess of an amount equal to one-half of the paid-up capital of the Company for the time being." The Company suggest a standard price of 4s. 3d. per 1000 cubic feet, with the sliding-scale operating half-yearly. Clauses follow regarding the purchase of the Hirwain Company's works and for the extension of the limits of supply. The calorific value test is to be substituted for the illuminating power one; and a level standard of 475 B.Th.U. is proposed, tested by the apparatus prescribed for the time being by the Metropolitan Gas Referees. Under the clause dealing with the construction of gas-works, the new residuals provisions appear, but (properly) without the one-third purchasing restriction. There were precedents for this omission during the session of last year. Among miscellaneous clauses, it is seen that the Company desire to be exempt from supplying gas where a main is of insufficient capacity. Profit sharing and stand-by clauses also appear. In connection with public lighting, the Company wish section 46 of the Act of 1869 to be amended by the insertion of the words "for lighting purposes" after the word "consumer" in the first proviso of the section. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

The Beighton and District Gas Company is a "limited" concern, which supplies gas in the parish in Derbyshire which gives to it its name, as well as in Aston-cum-Aughton in the West Riding of the county of York. The nominal capital is £20,000, of which £15,371 in shares have been subscribed. The Company now seek re-incorporation and statutory powers. It is proposed that the capital shall be £23,371, which gives £8000 as additional capital, of which not more than £5000 is to be raised as preference shares or stock. The borrowing powers are placed at one-third part of the issued and paid-up capital. The restriction is included as to raising money during the war, and for twelve months afterwards, without the consent of the Treasury. On the original capital the standard rate of dividend proposed is 10 per cent., and on the additional capital 7 per cent., or not exceeding

6 per cent. on such portion as is issued as preference. In connection with the construction of works clause, the residuals provisions appear, and rightly without the one-third restriction. The Midland and Great Central Railways have protective clauses; and so have the West Riding and Derbyshire County Councils. The area of supply is defined. The standard price of gas is put at 4s. 2d. per 1000 cubic feet, with the sliding-scale operating annually. A level calorific value standard of 500 B.Th.U. is proposed in lieu of the illuminating power one, the testing to be under the prescriptions of the Metropolitan Gas Referees. A number of clauses of ordinary character in modern gas legislation are included in the Bill. [*Parliamentary Agents: Messrs. Torr, Durnford, and Co.*]

The Colchester Gas Company have been experiencing a great increase in the demand for gas within the borough in recent years, and especially since the commencement of the war. They have extended their mains beyond the borough for meeting the demands for gas; and these mains have been further extended for the purpose of satisfying military requirements. In view of these increases and the potentialities, the Company desire to construct new gas-works, and to have their limits of supply extended. Under the Company's Act of 1866, their capital was: Original, £20,000; additional, £20,000. Loan: Original, £5000; additional, £5000. Under the 1875 Act, £10,000 additional was authorized, and £2500 of loan capital. The whole of the authorized share and loan capital has been raised; and the Company have in addition, received an amount of £4815 by way of premiums. Beyond the authorized share and loan capital (including the premiums), they have expended on purposes to which capital is properly applicable, a sum of £2600, which now stands to the debit of the capital account. They require to be empowered to extinguish this debit. Lands are scheduled on which the Company desire to construct further works; and following the works clause is the new residuals provision, without, as in the preceding cases, the one-third restriction. Power is desired to erect two bridges or overhead constructions over Hythe Quay Road for the conveyance of coal and other commodities from and into the gas-works, with authority to operate the overhead constructions by electric, steam, hydraulic, or any other form of mechanical or animal power. If these overhead constructions are not completed within the period of five years from the date when the Treasury shall give their consent to the raising of the money requisite for the erection, or within a period of six years from the termination of the present war (whichever is the earlier period), then, on the expiration of the earlier of such periods, the powers are to cease, except as to so much as is completed. Power is required to stop up a footpath, and construct a new one. Extension of the limits of supply is sought, together with confirmation of the laying preceding authorization of mains in the extended area. The Company propose a calorific standard in place of the illuminating power one. They suggest adopting a "calorimeter to be agreed upon between the Company and the Corporation, or, failing agreement, to be approved by the Board of Trade, which shall be so constructed as to be capable of yielding the total heat value expressed in British thermal units, of the gas supplied by the Company." The standard is the marginless one of 500 B.Th.U. The requirement as to additional capital is £90,000. The prescribed scale of voting in respect of any stock in the additional capital authorized by the Act is proposed as follows:

> Every holder of such stock shall have one vote for every £20 of stock up to £200; and he shall have an additional vote for every £100 of stock beyond the first £200 thereof held by him up to £2000 of stock, and an additional vote for every £200 of stock beyond the first £2000.

The dividends are to be on any preference capital issued as additional capital under the Act, such rate (not exceeding 7 per cent. per annum) as shall be specified in the resolution creating such stock; on the original capital, 10 per cent. per annum; on the additional capital, under the Acts of 1866 and 1875, and on any ordinary capital issued under this Act, 7 per cent. per annum. On mortgage the Company may borrow in respect of the fully paid-up capital of £50,000 created or issued under the Acts of 1866 and 1875 and of the premiums received, any further sum not exceeding £5500, and in respect of the additional capital authorized by the present Bill one-third part. Power is to be taken to issue redeemable preference capital or debenture stock, and for the formation of a redemption fund. The Treasury clause appears as to raising money during the war and for twelve months after. Regarding the extinguishing of the capital debit balance, the following clause is proposed:

> The Company may, at any time prior to the 1st day of January, 1917, transfer to capital account such sum or sums as they think fit out of the amount standing on the 31st day of December, 1915, to the credit of the profit and loss account which was carried forward to the next account, and any sum or sums so transferred shall be applied firstly in extinguishing the amount of the debit balance on capital account at the passing of this Act, and then to any other purposes of the undertaking to which capital is properly applicable.

The standard price for gas is put at 3s. 9d.; with the sliding-scale operating half-yearly. The charge for gas to consumers in the extended area, it is proposed, shall not exceed the price in the borough by more than 9d. Provision is made for differential prices according to the purpose for which gas is used, "provided that the Company shall not, under the powers of this section, give any preferential price as between any consumers who shall take a supply of gas for the same purpose under like circumstances." Pension and profit-sharing clauses are included; and amendment is desired to the "Price of Gas for Public Lamps" clause of the Act of 1875 by the insertion of the words "for gas supplied for lighting purposes only" after the words "charged from time to time." The prepayment clause provides for the usual 10d. for meter and fittings, and 1s. if including cooker; but it is added, "or in either of such cases at the rate of 10 per cent. per annum on the cost of the meter and fittings, whichever shall be the higher." Most of the other clauses are now common to all Gas Acts. [*Parliamentary Agents: Messrs. Rees and Freres.*]

The Ferndale Gas Company is a "limited" one; but it is now proposed to clothe it with full statutory powers. By the Company's Order of 1883, it was provided that the capital should consist of the original share capital of £10,000 and of additional capital not exceeding £10,000, with borrowing powers amounting in their entirety to £5000. The whole of these sums have been issued; and premiums have been received in respect thereof amounting to £1259. The dividend on the original capital is 10 per cent., and on the additional capital 7 per cent., subject to the operation of the sliding-scale. The Company have raised £5000 by the issue of debentures, in conformity with the 1883 Order; and they have also borrowed sums amounting in the whole to £11,400 otherwise than on mortgage of their undertaking. A structural valuation of the works, &c., amounts to £33,860. The expenditure on the undertaking totals £37,660; and it is now considered expedient that the unproductive capital —amounting to £3800—should be redeemed and cancelled. In the additional capital to be authorized, the Company desire to include the money requisite to pay off the loans of £11,400. Another matter which the promoters wish to be dealt with is that, under the powers of the Order of 1883, they acquired certain leasehold lands, and have erected thereon a gasholder and other works, which have been used for the storage of gas since 1896; and they now submit that it is expedient to empower the Company to store gas on the lands, and certain adjoining lands proposed to be used for this purpose. The foregoing facts are taken from the preamble. From the clauses, it is seen that the proposal in respect of additional capital is £25,750, provided that the share capital under the 1883 Order and this Act shall not exceed £45,750. The dividend on the additional capital is proposed at 7 per cent. on the ordinary, and not exceeding 6 per cent. on the preference. It is asked that section 25 of the 1883 Order [Fixing Maximum Price of Gas, with Sliding-Scale as to Dividend], in its application to so much of the additional capital as is issued as ordinary, shall be read and have effect as though 3s. 6d. had been inserted therein instead of 5s. Borrowing powers are desired on the customary one-third line. A capital redemption fund is asked for. In any year in which the divisible profits exceed the amount required to pay the dividends on the preference capital, a dividend at the rate of 5 per cent. per annum on the original share capital, and a proportionate dividend on the additional share capital (whether issued under the Order of 1883, or under the provisions of this Act), the Company "shall transfer to a fund to be called the 'capital redemption fund' the balance of such divisible profits remaining after paying the said dividends, provided that, as soon as the Company have transferred to the fund sums amounting in the aggregate to £1900 this subsection shall cease to operate and have effect." The Directors may, in addition, if they think fit at any time appropriate out of revenue as part of the expenditure on revenue account, and transfer to the fund, any sums not exceeding in the aggregate £1900. Every sum so transferred is to be applied to the purchase of ordinary or preference shares or stock, which is to be cancelled and extinguished. Except in the open market, the Company are not to purchase any shares or stock at a price exceeding that at which, according to the records of the Company, the last transaction in shares or stock of the same class took place. The Treasury capital restriction clause, it is proposed, shall be extended as follows:

> Notwithstanding anything in this Act, the Company shall not under the powers of this Act raise or borrow any money, except (*a*) for the payment of the costs, charges, and expenses referred to in the section of this Act of which the marginal note is "Costs of Act;" (*b*) for the discharge of the recited loans amounting to £11,400; and (*c*) a sum of £8000 for the payment of an additional gasholder now in course of construction, during the continuance of the present war and twelve months thereafter, unless the consent of the Treasury has been previously obtained.

The illuminating standard and test are to be abandoned in favour of a level 500 B.Th.U. standard, with test under the prescriptions of the Metropolitan Gas Referees. Differential prices, with a guard against preferential prices, are provided for. As in most of the other Bills, protection clauses appear as to the supply of gas where there is an alternative supply of gas and electricity, and where mains are of insufficient capacity without jeopardizing private supply. [*Parliamentary Agents: Messrs. Lees and Co.*]

Dr. Frederick S. Pearson, of Great Barrington, Mass., who was at the head of the group of capitalists controlling, among other undertakings, the Brazil Traction, Light, and Power Company, the Barcelona Traction, Light, and Power Company, the Rio Janeiro Tramway, Light, and Power Company, and the Mexican Light and Power Company, left estate in the United Kingdom of the gross value of £328,860.

ELECTRICITY SUPPLY MEMORANDA.

A REVIEW OF THE PAST YEAR.

The general experiences of the electricity-supply industry during the past year have been very much the same as those of the gas industry, with perhaps greater divergencies between different electric undertakings owing to the wide dissimilarity in circumstances. The same influences that have affected gas undertakings have borne upon electricity concerns. Coal has been the *bête noire;* street and shop lighting restrictions have curtailed business; and the undertakings have not escaped household economy. But in those favoured districts near to the coal-fields, and where there has been a flood of munitions work, and electric power has been in large demand, there affairs have had a more gladdening aspect than in those localities where the electricity concerns have had to pay heavier costs for fuel delivered, and where perhaps their main source of income has been residential. These latter must have been very hard hit. However, the electricity supply industry has not had to deal with residual products under war conditions; it has not had to help the country to obtain from within itself many substances that are urgently required in the war; and it has not had to help forward the dye scheme by producing raw materials necessary to its existence. Nevertheless, within the limits of its activities, it has, speaking generally, been badly affected.

Under War Conditions.

In connection with coal, the electricity industry—at any rate, in some quarters—does not appear to have properly gauged what should be its position to meet times of great emergency. Early in the year many undertakings were suffering from shortage of coal—for the same reasons as were described in our Gas Retrospect of last week; and they were faced, too, with much heavier expenses for their next contracts. Under the circumstances (though the electricity supply industry was not so deeply involved in the coal trouble as was the gas industry, owing to the quantitative difference in requirement), the gas industry had a conference with its representatives, and mapped-out a movement for seeking relief from the then present, and greater menacing, conditions, which movement has borne good fruit. But notwithstanding the experience of last winter and the spring, notwithstanding, too, the warning given some months ago as to the prospects of this winter, notwithstanding the opportunity there was during the summer and autumn months for stocking coal, of which there was then an abundant supply, before Christmas there was an outcry as to deficiency of deliveries and vanishing stocks. The fuel bill is this year going to be a heavy one for all electrical undertakings; and many of them with contracts for power at prices calculated out (under normal conditions) with such mathematical accuracy that the profit said to exist on the charge per unit is not visible to the naked eye, will stand to lose on them, unless subject to a coal clause. In consequence of the coal position, quite a good number of central stations have taken to using coke or coke breeze; and so necessity has compelled an experience which it was difficult to secure under ordinary circumstances, and with custom resolutely governing. Engineers have found that, with mechanical stoking arrangements and forced draught, most excellent results are attainable—results exemplified by Mr. E. W. L. Nicol (the technical expert of the London Coke Sales Committee) when he said that 1 lb. of average gas coke is capable of evaporating 10 lbs. of water from and at 212° Fahr.

Then there have been the restrictions as to capital-raising for extensions and expansion of business. The Local Government Board have proved themselves excellent watchdogs for the Treasury in this matter; and unless the managements of concerns have been able to prove that the necessity for expenditure arises in connection with munitions work, they have been met with a blank refusal, or have only been allowed sufficient money for meeting some actually pressing requirement. But it was wonderful what a number of managements discovered, after the capital restrictions were imposed, that extensions of their plant were urgently needed; and it is equally extraordinary what a considerable proportion of the undertakings have found that, under compulsion, they are getting along quite nicely without the expenditure. The Treasury and the Local Government Board have been acting wisely in this matter; for present dear capital, dear materials (especially copper), and dear labour would not assist the future economic position of electric supply concerns. But what has grieved many a short-sighted electrical writer on the subject has been that the restriction has been a hindrance to business development. After the war, the administrators of electricity undertakings will be better able to take measure of their position and prospects than they are now. That the financial position of many central stations under current circumstances is something of grave concern to the managements is confessed by the resistance offered to the making of concessions in respect of the lessened street lighting and the lamps supplied under contract for shop lighting. Advances in prices to electricity consumers have been pretty general throughout the country; but there have been protests in certain electrical papers against the full burden of the extra costs due to the war falling on consumers. Whence those who have made protest think that in the case of municipal concerns the money should come, we do not know. But there are some concerns that will, through not putting all the burden on the consumers, have to unfairly have recourse more heavily than ever to the rates, and the number of concerns that will require assistance will be larger than in normal times—simply because of the fear that by putting up prices to an amount that will produce a clean balance-sheet, consumers will be induced to transfer their custom. This is an acknowledgment of the part that price has in the maintenance of electrical custom. With regard to supply companies, they are putting, practically speaking, all the additional cost on the consumers, and (unlike the sliding-scale gas companies) are not allowing their dividends to be affected, or anyway but slightly.

Trading.

We must admit that there has been during the year a lessened display of that particular form of electrical lunacy that has in the past regarded as dispensable the gas industry and all its products. The war has done something to force into the vacuity that former evidence showed existed in not a few electrical skulls some ideas as to the large place that the gas industry occupies in the affairs of the world, in addition to supplying light, heat, and power. But though there has been this diminished display of foolishness and indiscretion, there are indications that the electricity supply industry intend to keenly persevere with business development immediately it is released from its present limitations at the close of the war. The Incorporated Municipal Electrical Association have at work a Sales Development Committee, which is divided into Sub-Committees for special purposes. The Committee are at work; but nothing great in the nature of the result has yet been disclosed. The old Electricity Publicity Committee is still breathing, but is more than ever incapable of energy and good work. There was a suggestion made that there should be a fusion of the Committee and of the Sales Development Committee; but the older body is against ending its useless life by the process of absorption. A point that has been raised more than once in the course of the year has been the trading antagonism between municipal gas and electricity committees. There has been quite a considerable amount of trouble over the matter; but Mr. J. G. Newbigging ventured to suggest a way that might, or might not, produce lasting peace. It was a feature of his British Association paper; and it was to the effect that, where gas and electricity concerns were municipal possessions, the whole of the lighting should in time to come be taken over by the electricity undertakings, and the gas undertakings be left in charge of the heating field. Neither the one industry nor the other would ever agree to any line of demarcation being placed upon its operations; but the idea coming from the Chief Gas Engineer of the Manchester Corporation, gave our electrical friends an opportunity of doing a little screeching over the supposed admission of a weakening of the gas industry on the side of lighting, and of a growing superiority of the electricity industry, which, of course, taking all things into account, no one in the gas industry subscribes to—excepting perhaps one or two men.

In the Lighting Field.

By those who make close observation, it is acknowledged that there is little chance in the lighting, heating, and power fields of electricity making much, if any, further progress in efficiency. Take incandescent lamps for example. The finding of materials for filaments that will stand higher temperatures seems to defy all research; and, even if such materials could be found, the intrinsic brilliancy of present filaments has reached a point that is inflicting considerable harm upon the eyesight. With regard to electric heaters, there are some that have had attributed to them an efficiency of 80 per cent.; and it is claimed that motors of moderate power, speed, and voltage are on the market with an efficiency of 85 per cent. So that, looking at these claims, there is not much chance of further increasing the efficiency of electric appliances.

In connection with the so-called "half-watt" lamp, the fraudulent character of the name has been conceded by some manufacturers and several conscientious electricians; and it is now called by them the "nitrogen-filled" lamp. There has also been a movement to rate lamps on their wattage, owing to the unreliability of the candle power of lamps, even when drawn from the same batch; but the absurdity of a wattage rating alone as a description is evident from the different efficiency of different lamps. With some lamps 1-candle power is obtained from (say) 1·7 watts, and in another lamp from (say) 0·75 watt. If all possessed the same efficiency, there would not be so strong an objection. But the consumer requires to know for guidance what he may expect in the way of candle power for the consumption ascribed to any given lamp. It is also admitted that, in the case of metallic filament lamps, the light emission is less in all other directions than the horizontal, and that the mean spherical candle power is about 20 per cent. less than the horizontal (or nominal) candle power. However, to return to the "half-watt" lamp, there has been a large displacement by these of electric arc lamps in the streets, on account, first, of the shortage in the supply of carbons due to the war, and, secondly, because of the reduction of labour in cleaning and trimming. But it is confessed that, owing to the high temperature at which the new lamps are run, there is considerable trouble with the fittings. Of course, some electrical writers assert that there is not any trouble; the more truthful state otherwise. With mixed feelings, electrical engineers received the intelligence that lower "half-watt" units were available—that for pressures of 200 to 250 volts, lamps were on the market of 200-candle power; for pressures of 100 to 120 volts, lamps of 120-candle power; and for a pressure of 25 volts, lamps taking only 15 watts per hour. The prices of these new lamps were quoted in the "Memoranda" for July 13. It is stated that, by using argon instead of nitrogen for filling the bulbs, smaller units suitable for domestic use will soon be on sale; but central station engineers do not generally look with magnanimous feelings upon lamps that will reduce their domestic lighting load—the price received for the lighting units being the backbone of their revenue. Another high-efficiency lamp has been produced by the Edison-Swan Company. In respect of shape, size, bulb, stem, and cap, its characteristics are those of an ordinary incandescent lamp; but it has an arc as the source of light. Its efficiency is stated to be 2 candles per watt; but it has an intrinsic brilliancy of no less than 10,000 candles per square inch, as against 1000 candles per square inch with the metallic filament lamp, and 375 candles per square inch with the carbon filament lamp. Dealing with the subject of the ideal light, Dr. Herbert E. Ives stated during the year that the vacuum type of tungsten lamp is three hundred times as bright as the brightest object by day—viz., a white surface in the sun; while the nitrogen-filled tungsten lamp is a thousand times as bright. It is obvious from this that these lamps are not "ideal" as lighting agents; and the new production of the Edison-Swan Company is far from being so, though it will without doubt have scope in application to special purposes. However, with all high intrinsic brilliancy lamps, there must be protection for the eyes. In this connection, Mr. L. Crouch stated in a series of articles published in the course of the year that, used with indirect lighting fittings, the efficiency of the "half-watt" lamp is not higher than 1 candle per 1·6 to 1·7 watts.

It is interesting to note that at Woolwich Arsenal, additional high-pressure gas-lamps have displaced arc lamps—thus releasing energy for machine-tools; that at Belfast gas has displanted electric lighting in the streets, so as to relieve the central station; and that on the tramway route at Preston, gas has, after comparative trial, been chosen in preference to electric-lamps.

There has been a revival of talk and experiment in respect of the lighting by electricity of workmen's dwellings at fixed prices. But time after time it is found the project does not get beyond, or very little beyond, the experimental stage, although figures are published to show the "profitable" nature of the venture. But, as a rule, the figures refuse to stand any analytical test. The Fixed Price Light Company do not make any disclosure as to whether or not they are making a success of their enterprise; but at Wimbledon proposals have been made for putting an end to the agreement between Council and Company.

During the year, the report of the Committee on the Lighting of Factories and Workshops was issued; but it did not altogether please one electrical writer, because it was not sufficiently anti-gas or sufficiently pro-electricity. One point of interest was that ophthalmic surgeons supplied evidence that workers frequently complained of harm to their eyes where electric light was used. And yet tests at the National Physical Laboratory with workers showed that there would be considerable uneconomy if indirect or semi-indirect systems were adopted in factories, owing to the larger amount of current that would have to be consumed in order to give the workers sufficient light.

Electric Cooking.

With regard to electric cooking, progress is slow, due to a combination of retarding factors which cannot be dismissed. There is the high initial cost, and the expense of maintenance. Unreliability, too, is complained of, even by electrical engineers. We had example of this in a paper read by Mr. W. R. Cooper before the Institution of Electrical Engineers; as well as in a discussion by the "Point-Fives." Voltage variations and surges have also a bad effect upon uniformity of operation. Besides electricians have cause to complain bitterly of the waste of electrical energy by servants. It is in the hot-plates where most waste occurs, and where breakdowns are the most frequent. Owing to the costs, and the reluctance of householders to spend money on electric cooking apparatus, a new tariff has been adopted at Marylebone—a lump sum, and, instead of ½d. per unit beyond, ¾d. per unit; the additional ¼d. being to cover the hire of apparatus. From published information, it is seen that electricians do not credit electric appliances with long life—15 to 50 per cent. on cost being the range of hiring rates for different towns and different appliances. Among new ideas—this emanating from America—is the thermostatic control of the temperatures of electric-ovens; but the difficulty is that in cooking many different temperatures are needed. Not much has been heard during the year respecting water-heating. Mr. A. H. Seabrook still persists in his postulation that water-heating can be done electrically as cheaply as by gas; but he does not appear to be prepared to take part in a conclusive demonstration to prove the assertion. Of course, he knows full well that in such a comparison electricity would show up very badly—in more ways than the one of cost. Most electrical engineers recommend water heating by coke where electric cooking is adopted.

Heating.

In electric heating, the so-called "radiators," with Teutonic sausage-shaped heating lamps, appear to be going to the scrap-heap. The gas industry has mercilessly sent many there, The electric successors are fires of the bar type—the bars being composed in most cases of fire-clay, with the wires run on the corrugated surface. Each bar has a loading of 800 to 1000 watts; and a fire may be made with up to five bars, which can be used individually or collectively at will. When the weather is cold, a fire running away with four or five units per hour will be an expensive form of heating. Several times during the year, some curious comparative figures have been put forward by electricians, to show that electric heating is no more costly than gas heating; but these are always worked out—completely ignoring scientific tests—on the assumption that the gas-fire has only an efficiency of 20 to 25 per cent. of the heat generated by the combustion of the gas. But the electricians who make these silly statements (there were some in the past year) cannot substantiate them; and it is clear that they go on guesswork, and not on the results of tests made scientifically and by men of reputation—such tests as those with which we have confronted them. Among other things that have invited attention during the year in connection with heating is the proposal that chimneys should be abandoned in bedrooms, and thus insanitary conditions be promoted in order to compel the adoption of electric "fires." Of course, electric fans could be installed. But these mean additional cost, and are prone to failure just when most required. And who could stand the incessant buzz of an electric-fan in the bedroom? In a pamphlet, Mr. George Wilkinson, of Harrogate, confessed that in an electrically operated house, the electric fires had to be supplemented by other means of heating in the winter. This is what one knows must happen if there is to be comfort.

Power.

There is little to say about the power branch of the business. The gas-engine prospers; and the electric-motor also receives considerable adoption. The steam-engine is suffering most from competition. It is agreed that for certain purposes, and in certain places, the electric-motor has conveniences; but in regard to costs, Mr. Tookey (as indicated last week) has shown the gas-engine to be the cheaper working medium for the manufacturer. A series of articles in our columns by Mr. H. C. Widlake has also shown the advantage of the gas-engine in respect of more than the monetary one. These articles also presented the fact that there is cheap provision of electricity through the gas-driven generating plant. During the year, the Southport Corporation Gas Committee stated that they had refused an offer of the Electricity Committee to supply energy at 1½d. per unit, seeing that they could generate it for themselves at a cost of less than ½d. In this connection, it will be noticed that Parliamentary Committees are not averse to allowing the hiring clause in gas companies' Bills to include dynamos with gas-engines, as witness the Spennymoor Bill. In connection with the supply of energy to motor-generators, some discussion has been raised as to whether this should be charged for at lighting rates or power rates. In the Alloa Sheriff's Court, it was held that it was a power charge. The stand of the electricity suppliers was made upon the fact that the electricity on the other side of the motor generator was used for lighting purposes. All electricians do not endorse this absurd contention. Mr. A. J. Abraham, of Aberdare, is one who does not. He stated, in a communication to an electrical paper, that he had entered into a contract with the Gas Company for the supply of electric energy; but he had not said: "I cannot supply you at power rates because you are using current for making gas for lighting purposes." There were complaints during the year that motor-generators, besides being uneconomical, are noisy.

Generating Plant.

There have been several attempts at deriving consolation from the fact that, with the coming of dear fuel, electricity production has been considerably reduced in cost by the steam-turbine. Mr. C. P. Sparks, President of the Institution of Electrical Engineers, in his address, particularly called attention to this; and he stated that the development of the steam-turbine, and the adoption of superheated steam, and suitable condensing facilities, had entirely changed the character of supply undertakings by increasing the size of the operating units. But, of course, only the more favoured stations can utilize the steam-turbine; and we come down to sizes where it is not economical compared with certain other forms of prime mover. As a matter of fact, even with the turbine, there is great heat inefficiency. Of the full energy of the coal, only about 70 per cent. reaches the inlet-valve of the turbine in the form of steam. About 80 per cent. of this energy is lost in converting it to mechanical power; so that there is only about 14 per cent. of the energy of the coal available at the turbine shaft. Only 10 per cent. reaches the lamp terminals; and of this only a small percentage is converted into light. The Accrington electricity supply station remains the sole producer-gas driven station in the country. But Mr. Sparks thinks that the next general step in advance will be boiler-firing by producer-gas, with recovery of bye-products. The Yorkshire Power Company are firing the boilers at one of their stations with coke-oven gas; and from Glasgow experiments have been announced in the firing of boilers with producer gas. Early in the year we published a description of the Wood Green gas-driven generating station of the Tottenham District Light, Heat, and Power Company. The users of Diesel oil-engines for generating electricity have had to bemoan the price of oil, and their choice of a prime mover.

Legislation and Legal.

The legislative work of the electricity industry was considerably tenuated by the withdrawal, at the request of the Government, the highly contentious London County Council Bill for co-dinating the electricity supply of London and a large environing ea, and of the Bill promoted jointly by ten London Electricity pply Companies. The Yorkshire Power Company lost their ll, which was intended to give them unusual powers in respect electric lighting without bringing them under the ordinary elec-cal legislative obligations. The Northumberland clause was serted in the Southampton Bill, at the instance of the Gas Com-ny, in respect of an extension of the electricity supply area. everal municipal Bills contained hiring and wiring clauses, of a aracter which aroused much opposition from electrical con-ctors, and led variously to defeat locally or else in the Parlia-entary Committee rooms, or to agreement for the adoption of e model clauses. In connection with their ancient Bill, the corporated Municipal Electrical Association tried to arrive at compromise with the Electrical Contractors' Association, but iled. The promoters are now proposing to introduce into the ll a clause to sanction modes of charging different from the ual statutory method. This evidently has something to do with e Long Eaton, Ilford, and South London decisions as to pre-rential charges. The Ilford case was one that caused some nount of consternation in the industry during the year, for it ferred not only to charges, but to the hiring-out of appliances, c., without specific statutory authority. The Pope Lamp Com-ny have up to the Court of Appeal defeated Osram Works, mited, in respect of their action for infringement.

Failures, Fires, and Fatalities.

The year has been marked by quite a number of failures of pply, fires, and fatalities. We have not a complete record, but ly examples—the electricity industry (we have heard of definite ses) having the knack of suppressing a goodly proportion of the ishaps. The "Lancet" during the year called attention to the tting-off of the electric current, during an air raid on the East-ast, while an operation was in progress at a nursing home. In nuary, there was a collapse of the supply at New Malden; on eb. 6, at Ammanford; on Feb. 8, in a large part of Sheffield; in ne, at Maidenhead; on Sept. 25, at Todmorden; on Oct. 12, at rmingham; on Nov. 17, at Wolverhampton; on Nov. 30, at ednesbury; just recently, and more than once, at Wigan; on ec. 5, at Finchley; on Dec. 9, at Luton; and also in December, the Congregational Church, Victoria Road, Newport, during a rvice, on which occasion the organ also broke down.

Several accidents at electricity stations with uncomfortable fects on the supply, as well as several triumphs in the way of e-raising, have occurred during the year. At the Ebbw Vale on and Coal Company's works, there was a disastrous fire; at ardiff considerable damage was caused by the bursting of a fly-heel; there was a big fire at the Belfast electricity station; and explosion was highly disastrous at the Dublin station. Earlier the year, the Ipswich power station suffered from fire. On eb. 9, there was a fire at the Newport Town Hall, which was tributed to an electrical mishap; on April 6, on the premises of e Young Men's Christian Association at Newcastle, through a ported defect in an electric motor which worked a fan to clear e air from a café in the basement; early in September, at the osalline works at Greenwich, there was a fire due to an electrical use; in September, at a Bradford Picture Theatre; and on ct. 29, in Old Change, St. Paul's Churchyard. An instructive mparative table, by the London County Council, as to lighting gents and fires, was published in the columns of the "Journal" r Aug. 24, p. 392.

In his last published annual report, Mr. G. Scott Ram, the Chief spector of Factories and Workshops, called attention to the mber of dangerous electric installations still found in factories d workshops. He also enumerated a large number of electrical cidents, including twenty fatalities, some of which were at ltages ranging between 140 and 250. There were several fatalities used by electricity in factories, mines, and elsewhere during 15. Some have been noticed by us; but only by way of ample, and not by any means as a complete record of these currences.

Shell Treating by Gas.—In the course of an article accom-anying a photograph of a set of shell-treating furnaces in use in e of Toronto's munition factories, Mr. H. E. G. Watson (of the dustrial Fuel Department of the Toronto Consumers' Gas Com-any) draws attention to the many uses of gas-furnaces in turn-g out munitions of war, and points out that not only have andard gas-furnaces been employed in this connection, but the ar has so stimulated men's minds that hundreds of gas-fired rnaces are now being used 24 hours a day which a year ago ere not even designed. He says there is nothing of this kind at requires more careful handling and more exact temperature an the heat treatment of shrapnel shells. If every little part is ot "just so," not only is the shell harmless to the enemy, but is actually very apt to injure our own men. During its manu-cture, the shell passes through no less than five different heat eatments, each one of which must be a definite temperature,

PERSONAL.

Mr. M. Spittle, the Manager of the Thurles Gas-Works, has been promoted to the managership of the Dungarvan Gas-Works, owned by the same Company.

Following upon the inquiry that has taken place into the working of the Mansfield gas undertaking [to which reference was made in the "Journal" for Nov. 9 last, p. 330], the connection of Mr. W. J. Rendell Baker with the Corporation is being severed, as will be seen from an advertisement appearing in our pages to-day for a successor to him as Gas and Water Engineer.

It is a pleasure to record that Second Lieutenant Gordon Helps (the only son of Mr. W. D. Helps, of Leeds) is included in Sir John French's recommendations for gallant and distinguished conduct in the field. Lieutenant Helps volunteered on the day war was declared, and was gazetted on Aug. 22, 1914, to the 3rd W.R. Brigade Royal Field Artillery (T). He has been in Flanders for many months.

Mr. William Belton, who has been Engineer, Secretary, and Manager of the Shrewsbury Gaslight Company for upwards of thirty-six years, has relinquished the post of Manager, but retains those of Engineer and Secretary. Mr. C. M. D. Belton, who has been with the Company for six years as Assistant Engineer and Secretary, is now also appointed Manager. These changes date from the 1st inst. Mr. C. M. D. Belton (a son of Mr. J. C. Belton, the Engineer and Manager of the Chester Gas-Works), during his service with the Shrewsbury Gas Company, has duly qualified by examination and has been admitted an Associate Member of the Institution of Civil Engineers, an Associate Member of the Institution of Mechanical Engineers, and an Associate of the Chartered Institute of Secretaries.

OBITUARY.

On Monday of last week, Mr. Samuel B. Clapham, of Keighley, who was 66 years of age, died after a brief illness. He was a son of the late Mr. Thomas Clapham, one of the founders of Messrs. Clapham Bros., Limited, of which firm deceased had been Chairman of Directors for some years.

The death has occurred, at Cassel, Hessen, Germany, of Dr. Heinrich Debus, F.R.S., who for many years was a lecturer on chemistry in this country. He was at one time (among other appointments) Professor of Chemistry at the Royal Naval College, Greenwich, in which position he was succeeded, in 1888, by the late Professor Vivian B. Lewes. He was also three times (on each occasion for a period of five years) appointed Examiner in Chemistry to the University of London. At the time of his death, deceased was in his 92nd year.

At Leamington, last Wednesday, the death occurred of Mr. E. Orford Smith, who was for over a quarter-of-a-century Town Clerk of Birmingham, from which position he retired, owing to ill-health, in 1907. Deceased, who was 74 years of age, was long regarded as an authority on municipal law. Among his many activities, it may be mentioned that he was a member of the Royal Commission on the Government of London, and also of the Royal Commission on Local Taxation. In 1865 he entered into partnership with the late Mr. Bolton, of Solihull; and while in business there, he promoted the Solihull Gas Company. In connection with the Welsh water scheme of the Birmingham Corporation he, of course, took an important part in the whole of the parliamentary proceedings.

NITRATE OF SODA POSITION.

Of late, through the newspaper Press and otherwise, both sulphate of ammonia and nitrate of soda have been to some extent before the public. On the one hand, there have been arguments as to the advisability or otherwise of allowing sulphate of ammonia to leave our shores; and, on the other, we have lately had an admission of the difficulty of getting nitrate in—that nitrate which it had been arranged should be brought from Chili to this country could not at present be imported, owing to the impossibility of securing the requisite freight.

This latter is a difficulty in connection with the nitrate of soda market which is emphasized by Messrs. W. Montgomery and Co. in their report dealing with the trade during the past half year. Sailing ships, they say, which before the war were obtainable at 20s. per ton, are unobtainable to-day for prompt loading at 80s., while steamers are sought for, but not found, at 120s. Only for March and April loading, and onward, might anything be obtainable at near these prices. Assuming that the demand for freight has been much greater than the supply, they look for higher, and not for lower, freights until this order of things is reversed—"which to-day seems to be not very near." These being the conditions, it is hardly surprising to learn that, while at June 30 due or arrived cargoes of ordinary quality were valued at about 10s. 9d. per cwt. cost and freight, it is doubtful if to-day one could be obtained at even 13s. 9d. for arrival at any time between now and next March. The demand of this country, of our Allies, and of America for nitrate of refined quality for explosive purposes has been growing apace; and under these circumstances it cannot be wondered at that prices continued to advance. Then followed the natural result. As prices advanced, oficinas which had been closed-down because of the unremunerative prices prevailing in the earlier days of the war, resumed operations; and this led to a considerably increased production, and then to a check to the high prices obtaining for nitrate f.o.b. in Chili. It is, Messrs. Montgomery think, somewhat questionable whether the check and consequent fall in prices was not brought about by the closing of the Panama Canal to traffic and the difficulty of obtaining freight; but, as they remark, it is quite certain that nitrate in Chili is of no use to European or American consumers, whatever the price, if it cannot be conveyed to their door.

Referring to the matter mentioned in the opening paragraph of this article, the report points out that some weeks ago importers were deterred from making provision as usual for their season's requirements by rumours of a large quantity of nitrate which might come on the market at much lower prices than those at which they could combine nitrate and freight. Only within the last few days has it become known that this nitrate is not likely to be shipped, owing to the impossibility of obtaining freights; and thus it is they fear that the supply will be sufficiently slender to bring about further advances. It is, however, the report proceeds, "well to know that the farmer is, generally speaking, well able to afford any advance which is likely to take place, and will make use of all the nitrate he can obtain, in order to bring the largest possible amount of cereals or root crops to the remunerative markets now obtaining."

With regard to prices, it is remarked that during the past six months these have advanced without a break so far as nitrate in stock in Europe and afloat was concerned; but the f.o.b. price in Chili reached high-water mark about mid-October, when 9s. 9d. per quintal for refined and 9s. 7d. for ordinary quality were reached, up to January shipment. About that time considerable business also took place in Chili at 9s. 1d. per quintal for January-June shipment, and 8s. 3d. July-December, 1916, for ordinary quality; while the figures for refined were 9s. 5d. and 8s. 8d. per quintal respectively. Business also took place for as far forward as the whole of 1917, in ordinary quality at 7s. 9d. and in refined at about 8s. 1d. per quintal. From mid-October onward, however, prices declined; and to-day, we learn, quotations are rather nominal, for lack of tonnage, so far as the next six months are concerned. A feeling of depression from this cause and the shadow of increasing production has come over the f.o.b. market; and Messrs. Montgomery think that possibly they would not be far wrong in saying that there is but little difference in prices for any positions from now to the end of 1917—taking these at about 7s. per quintal for ordinary, and 7s. 4½d. to 7s. 6d. for refined. At the same time, they add, it is tolerably certain that, until a more plentiful supply comes forward, prices on this side can only advance; and it is doubtful if any easing-off can take place before Midsummer, if it does then.

Though it is found hardly practicable to give figures, owing to the difficulty of obtaining accurate stock returns, the opinion is expressed that consumption in the United Kingdom has probably been maintained during the past six months so far as agricultural quality is concerned, but that the consumption of refined quality has trebled. Shipments to Europe for the half year just closed amounted to 651,000 tons, as compared with 386,000 tons, or an increase of practically 70 per cent. In the some period, the American consumption has increased 126 per cent.—from 236,000 tons to 534,000 tons. Present stocks in Chili amount to 17 million quintals, against 23½ million quintals a year ago; but it is thought the shutting-down process may soon again be in operation, because of the unremunerative prices to many producers.

THE METAL TRADES IN 1915.

In every branch of trade the conditions during the past twelve months have, of course, been abnormal; and this has been the case to a special degree with regard to all those branches which are directly or indirectly identified with war material. Thus it is that on the present occasion we find Messrs. Bolling and Lowe, in the annual review of the iron, steel, and copper trades, confessing themselves confronted by a series of complicated situations that are unprecedented, but which present a singularly instructive study of the commercial and financial conditions at home and abroad. Hindrances, curtailment of production, dislocated railway transit and shipment, shortage of labour, increased demand in certain directions, and limited sources of supply, have all united to create difficulties for the metal merchant and consumer to an extent never before experienced. Twelve months ago, it was impossible—in the first few months of the war—to say anything definite as to what might be in store; and now, at the beginning of another year, who can have greater confidence in predicting the future of the metal market?

With regard to the present, Messrs. Bolling and Lowe say it is easy to account for the fact that prices of all commodities have reached such a high level. In more than one instance quoted in the report, it is noticed that in a twelvemonth or less the price has been practically doubled; while many articles are from 30 to 40 per cent. dearer—"nor is all this increase unjustifiable," it is remarked, "considering the high rate of wages ruling, and the fact that the enormous Government demands for war material leave only a small surplus available for ordinary requirements." So far from anticipating any reduction in prices while the present state of things continues to exist, rather the contrary, the firm say, may be looked for. It is pointed out, too, as a view which will specially appeal to the shareholders in various industrial companies, that, though it is undeniably a hardship that the consumer should be compelled indirectly to bear so much of the burden of enhanced cost, it must at the same time be borne in mind that this applies also to those manufacturers who during the last two or three years have suffered under a period of reduced profits, and who, when they have an opportunity of recouping themselves, are compelled to surrender a large proportion of their earnings in the form of increased taxation.

Some reference is made in the report to the congestion of the various railway systems which has been a feature of the past year; and the opinion is expressed that the dearth of trucks, the restriction of the employment of those belonging to the various companies to their own respective traffic only, and the trouble in obtaining those belonging to other owners, except for special purposes, as well as the difficulty in getting temporarily disabled waggons repaired, will possibly lead to legislation at a later date, with the view of centralizing control. Attention is drawn, also, to the "singular attitude, probably induced by force of circumstances, taken by the railway companies in connection with shipping." Exports have, of course, been affected by the withdrawal from the market of a large number of merchant steamers; but it seems that the difficulties encountered in getting goods out of the country have been of a manifold character. One of these difficulties has been the refusal of the railway companies to carry goods to the seaports until they had received a definite undertaking that a certain vessel was prepared to receive them on their arrival. Then the shipping companies were not always in a position to guarantee to receive certain goods, but often only signified their willingness to do so in a given time which was insufficient for the railway company to effect the delivery. As is generally known, many regulations have from time to time been published with regard to materials allowed or disallowed to be exported; and it is found that much delay is consequently caused in making application for permits. With all these obstacles in their way, manufacturers in many cases decline to execute orders, or even to commence working on goods, until they receive assurances that, when ready, they can be shipped forthwith, or that they will receive payment when the goods are ready at the works. Speaking of the high freights that have been charged—in many cases four or five times the normal figures, and in some as much as ten times those ordinarily ruling—and the consequent rich harvest many shipowners are enjoying, Messrs. Bolling and Lowe say that there is, however, another side to the picture, and that is where owners have entered into extended time charters, before the war, spread over a number of years, and are now running their boats at heavy loss. There is, further, the serious question of detention; for it is declared that steamers have been known to be detained in London for three months and more, for want of labour in loading and discharging. At the same time, they admit that shipowners will, on the whole, have had every reason to be satisfied with the past year.

As to actual figures quoted, it is stated that pig iron warrants have advanced about 25s. per ton since the last report; and hematite and "makers' iron," considerably more. The war has to a great extent affected the production of rails; many large rolling mills having relinquished making them for the time being in favour of more urgent and more profitable work. There has been a considerable advance in the value of rails; the few works still rolling asking from £11 to £12 per ton, according to specification. The price of copper rose from just under £63 per ton in January to £80 per ton in November; galvanized sheets, from £12 5s. to £24 5s.; pig iron, from 57s. 6d. to 72s.; and joists, from £8 to £12. Tin at the commencement of the year was £168 5s. per ton; and the price fell steadily, until in September it was no more than £150. Since then, however, there has been a recovery to just beyond the opening price—namely, £168 15s. per ton. The figures mentioned are not claimed to be more than approximate.

The review concludes with the customary figures relating to this country's exports of iron and steel, and their values, for the eleven months ending Nov. 30 of each of the past three years. The figures for pig iron are given as follows: Year 1913—1,050,682 tons, value £4,535,759; 1914—748,986 tons, value £2,839,912; 1915—536,725 tons, value £2,983,515. Wrought tubes and fittings: Year 1913—150,303 tons, value £2,718,539; 1914—121,954 tons, value £2,060,771; 1915—95,564 tons, value £1,995,468. The total exports of iron and steel were: Year 1913—4,569,637 tons, value £50,208,580; 1914—3,678,631 tons, value £39,373,157; 1915—2,944,838 tons, value £36,909,103.

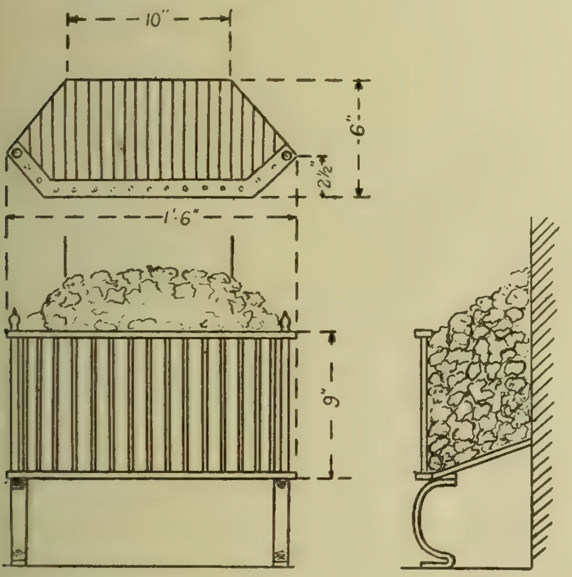
New Year's Honours.—Included among the recipients of New Year's Honours at the hands of His Majesty the King, there are several names well known in the gas industry. Sir Daniel Ford Goddard, M.P. for Ipswich (of the Gas Company in which town he was for fourteen years Engineer and Secretary, and is now Chairman as he is also of the South African Lighting Association, Limited), becomes a Privy Councillor. Sir Daniel, in addition to the chairmanships mentioned, is the Deputy-Chairman of the Tottenham District Light, Heat, and Power Company. Mr. D. A. Thomas, the Managing-Director of the Cambrian Combine and other collieries in South Wales, has been made a Baron. The honour of knighthood has been conferred upon Mr. John Boraston, J.P. (a Director of the South Suburban Gas Company).

OPEN GRATES FOR BURNING COKE.

By "Qui Vive."

A good many people have firmly rooted in their minds the conviction that coke without admixture with coal will not burn in an open grate. This conviction is usually founded upon some unsuccessful experiment of their own or upon that of some friend. It would be quite wrong to state that all coke will burn in all open grates, for this would be far from the truth. But, a great many open grates will burn coke quite satisfactorily; and this article is written with the idea of throwing some light upon a little-known subject.

First of all, it can be asserted with confidence that large coke will not burn in open grates as used in ordinary households. In all cases it must be "broken" coke. Secondly, only those grates which will permit of the coke being piled-up to a height of about 8 inches—10 inches is better—are suitable for the purpose. The modern "well" type of grate is admirably adapted for burning coal; but it is quite unsuitable for burning coke. The fact is, coal and coke require absolutely opposite conditions, if each is to be burnt in a proper manner. Coal should be burnt in a thin layer with a large grate area to allow the air to obtain access to the whole of the fuel. Coke, on the other hand, should be burnt—and indeed will only burn—in a thick layer; while the area of the grate can be quite small provided that the proper thickness of fuel is ensured. This being so, it will often be found that the unsatisfactory grate for burning coal will do very well for burning coke. Coal, if burnt in a thick layer, will require a great deal of poking to break-up the tarry masses of caked fuel, and without constant attention this type of grate gives very poor results with coal. Even so, such grates are not often deep enough to provide for a sufficient thickness of coke, or, to put it in another way, an extra inch or so of depth would make sure of a good coke fire on all occasions, even when the coke is somewhat damp and heavy in ash and the draught poor. The extra two or three inches of depth are a reserve to provide against bad conditions, which sooner or later are bound to be experienced.



To prove the truth of the statement that broken coke will burn satisfactorily in an open grate of sufficient depth, the writer altered the grate in his office, as shown in the accompanying sketch. Since this was done, many months ago, broken coke has proved itself to be on all occasions a most satisfactory fuel, and more consistent one day with another than even coal could be. So long as the fire is kept fairly full by being replenished every hour or so, and the fire-bars cleared of ash two or three times a day, the fire has always been bright and hot.

The drawing here reproduced shows a home-made grate which was fitted into an existing fire-place. The front bars are made of ⅜-inch rod, with a piece of flat steel top and bottom. The floor of the grate may be made of cast iron in the usual manner; and in this case would be arranged on a slope corresponding to that formed by the coke when piled up. But this is unnecessary. It will be noticed that the height of the grate is 9 inches, which works well in practice, while the depth is 6 inches, which is also satisfactory.

To light the fire a special gas-burner, comprising four bunsen jets, is used; but nothing so elaborate is really necessary. If the grate be filled up with coke, and the gas lighted for about 15 minutes, the coke will be well alight. The fire can of course be lighted with wood and coal in the usual way; but gas is more convenient. It is found in practice that 1¼ cwt. of coke will provide a good fire for 48 burning hours per week in an office of moderate size. Except, however, in very cold weather the grate, as now arranged, is rather too large for the office, and would quite well heat a room at least 50 per cent. larger. It is probable that this fire costs not more than about one-half of what it would cost if coal alone were used, which shows that the subject should prove an interesting one to the domestic economist.

It may be stated that on no occasion have any sulphur fumes been noticed, and the atmosphere of the office has been throughout perfectly satisfactory. The writer is strongly of the opinion that the prevailing popular idea that coke cannot be burnt without emitting an undue amount of sulphur is altogether without foundation. A great deal of the original sulphur in the coal is removed at the gas-works in the process of carbonizing; and it is a sure thing that what is extracted with the gas cannot be left in the coke. If the original coal and the coke which it yields be both analyzed for sulphur, it is found that the coal and coke contains about an equivalent amount of sulphur, which goes to prove that there is not much in this bogey. A possible explanation of the popular idea may be that when coal or coke is burning properly, and the products of combustion are passing up the chimney, nothing offensive is noticed in either case; but when burning badly the coal-fire throws out clouds of smoke into the room in which the sulphur fumes, mixed with quantities of other noxious products of combustion, pass unnoticed. On the other hand, coke when burning badly emits its products, which are merely carbonic acid (CO_2) and a small quantity of sulphur dioxide (SO_2), together with minute quantities of other waste products, into the room, with the result that the sensitive nose has nothing to smell but the sulphur, which is accordingly exaggerated out of proportion to its actual amount.

It may be asked, Why must coke be burnt in a thick or deep layer? This may be explained by stating that a piece of coke, unlike a piece of coal, has no burning properties in itself. It contains no volatile matter, or, in other words, gas and tar. When coal is warmed this volatile matter is thrown off, and is ignited should there be any flame or red hot fuel to light it. The coal is then in a condition to burn itself away so long as any volatile matter remains. Coke, on the other hand, is merely carbon with a percentage of ash and moisture, and a carbon fuel of this kind can only burn *en masse*—that is to say, when a large number of pieces are lying in a heap, and in such a form that the requisite amount of air can percolate through the mass and combine with the carbon present to form carbonic acid (CO_2).

The writer has repeatedly noticed that when the broken coke is burnt in a sufficiently deep layer, a flame is seen at the top of the fire, which is not the case whenever the layer is too thin—say, less than 7 inches in thickness. This flame appears so long as the coke at the top of the fire is red hot, and the thickness of fuel is sufficient. In fact, it would seem that the open grate used with broken coke and constructed of an exceptional depth is virtually a small gas-producer, similar in some degree to those used for making producer gas for the driving of gas-engines and for other industrial purposes.

It should be explained that an open grate of this type should be constructed with vertical front bars, so as to allow the coke to fall as the fire burns down. If this be not done, the horizontal bars will certainly cause a hanging-up of the coke, with the result that an excess of air will pass into the centre of the fuel bed, dividing it into two layers; and in this way the essential condition that the fuel must be burnt in a thick layer will upset. Coke, being of an irregular shape and having a rough surface, is very liable to hang-up if given the opportunity; so that this point must not be overlooked when constructing or adapting a grate for this purpose.

It is suggested that ironmongers with an eye to business might offer to adapt existing grates to the design here shown. The expense entailed in altering a grate should not amount to more than could be saved in a few months on the particular grate by the use of coke instead of coal. The exhibition of the arrangement in the shop window, together with particulars of the economy to be obtained, would doubtless cause a good deal of inquiry. People should be reminded that the use of coke dispenses with the chimney sweep; and, further, no smoke or soot is thrown out into the room, nor into the atmosphere.

Exports of Coal.—The Board of Trade announce that a white list of regular and reliable importers of coal in neutral countries has been prepared; and shippers are advised to consult the list before applying for licences to export coal or gas coke to any particular firm, as this may prevent delay in dealing with the applications. It will be understood that licences must be obtained in all cases, whether the name of the consignee is on the list or not, and that the granting of licences is dependent upon the available supplies of coal and coke in this country and the other considerations which have to be borne in mind by the licensing authority.

Coal Tar and its Products.—Last Saturday's "Iron and Coal Trades Review" contained a brief reply, by Messrs. Hird, Chambers, and Hammond, to some remarks made by a correspondent, "Distillation," whose letter was referred to in the "Journal" for Nov. 30, p. 502. The Huddersfield firm write that they set the value of 5d. per gallon upon the total distillates obtained from the tar; but "Distillation" pointed out that creosote oil is quoted at 3¼d. per gallon, which is, of course, correct. But as he evidently intended to convey the impression that the oil referred to—namely, the total distillates from tar—was nothing more nor less than creosote oil, readers should be plainly given to understand that creosote oil is a residuum from coal tar distillates after the whole of the benzol, toluol, phenol, cresylic acid, and naphthalene have been removed. "Distillation" cannot under any circumstances whatever, they say, contradict the figures they gave in their previous communication, and "he will serve no good purpose by attempting to convey the impression that creosote oil is as valuable as the distillates from tar."

SOME USES OF GAS IN THE WAR.

The title prefixed to the present article is unambitious; but it is ample to go on with. "How Gas is Helping the War" would be a headline for a far bigger chapter than could be produced from any one source in the gas industry—if indeed from the combined efforts of many.

The purpose in view is to deal with one particular aspect of the immense and daily-increasing employment of gas-furnace apparatus in munition works all over the country; but the gas industry is helping not at one point but at many. Scarcely one of the numerous industrial uses to which gas appliances so admirably lend themselves but are called for by the requirements of the war, and always with the most efficient response.

The use of gas for power is invaluable in numbers of places engaged on war work; and the use of gas for lighting—always time-honoured—was never more honoured than just now. Last, and among the most important of all, the bye-products of the gas industry, toluol and benzol, are indispensable to that vital war service of to-day, the manufacture of explosives. One could wish, it may be remarked in parentheses, for a fuller realization by some of the powers that be, that as these two important materials are bye-products of gas manufacture, the output of them is proportionate to the output of gas; and wherever restricted railway facilities, or any other preventable hampering of the business of gas-apparatus manufacturers delays or diminishes their delivery of gas-consuming apparatus to the gas undertakings, this has the effect of keeping-down gas consumption—already reduced by the war lighting restrictions—and therefore also needlessly keeps down the production of toluol and benzol.

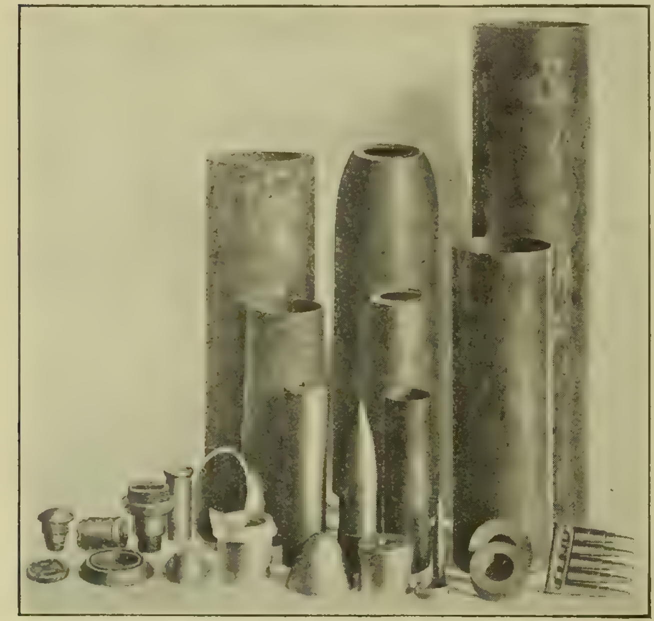


Fig. 1.—Group of Shells and Shell Parts, Cartridges, &c.

The variety of war purposes which gas is at present serving could not be better summed up than in the following excerpt from an official communication issued by the Director of Factory Construction in the Ministry of Munitions to the manager of every munitions factory in the country, strongly urging that, in face of the present need for an increased output of toluol and benzol, and of the shortage of labour, gas should be used as extensively as possible in all munition factories.

PURPOSES FOR WHICH GAS IS BEING USED IN FACTORIES.

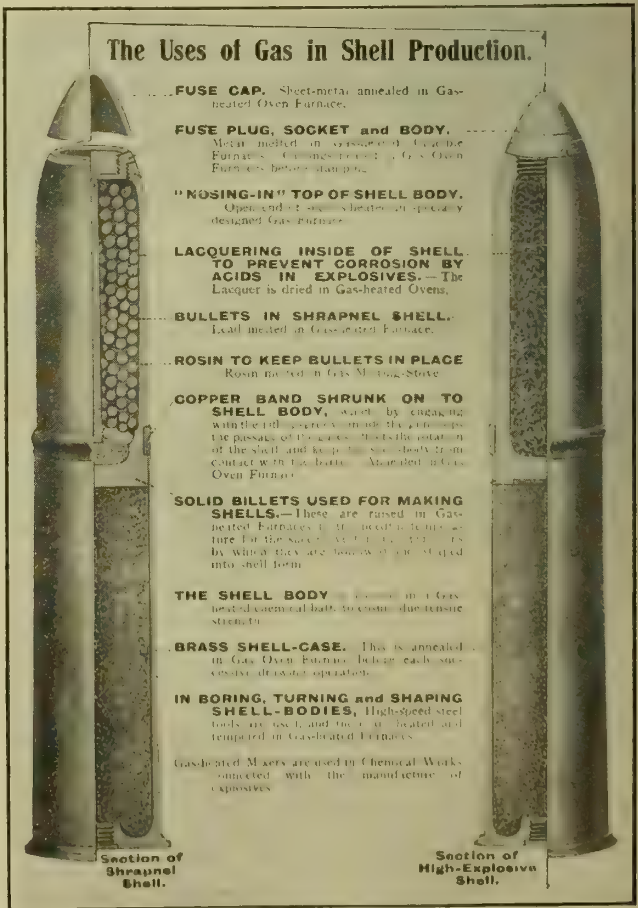
As an Illuminant:
  For all purposes. Incandescent burners should be employed in all cases.
As a Fuel (Cooking):
  For the provision of hot meals for employees.
As a Fuel (Water-Heating):
  For the provision of hot water for baths and lavatories and for washing purposes generally.
As a Fuel (Warming Purposes):
  For heating offices by gas-fires, and large rooms by means of gas-heated radiators.
As a Fuel (Manufacturing Processes):
  For the following purposes:
    Annealing steel and bar for billets in charges of from 2 to 10 tons. Consumption about 3000 cubic feet per ton of steel annealed.
    Annealing armour-piercing shells (15-inch).
    Nosing or heading steel-pressed shells.
    Heating copper bands for shrinking or pressing on to shells.
    Annealing brass for cartridge making.
    Welding bayonets.
    Forging, brazing, annealing, hardening, and tempering parts of small arms.
    Thermo treatment of steel in connection with gear parts for motor transports and of parts for submarine engines.
    Tempering and hardening tools.
    Heating of acids or other liquids in vats.
    Cloth pressing and tentering.
    Raising steam in moderate quantities.
    Melting and casting all descriptions of metals.
  Generally for all purposes involving the use of heat, either by direct application, or through furnace, oven, or internal heater.
As a Source of Power:
  In all size units up to 1000 B.H.P. engines and even larger sizes.

To state here in full the reasons why gas is proving so versatile a servant in war work would be to set forth all the numerous advantages of gas as a fuel—and these are already known to readers of the "JOURNAL." Among the chief virtues which have commended gas to managers of munition factories are doubtless the following: Saving of space, unequalled range of control, labour-saving effect, and elimination of waste—making for greatly increased efficiency. For example, in annealing processes, where coke or other crude fuels are used, a substantial proportion of scrap is unavoidable, whereas wherever a properly-designed gas-furnace is employed waste of this kind is reduced to a negligible point.

It is believed that an interesting light will be thrown on some of the excellent work that gas is doing for the war if we give a number of photos illustrating the variety of ways in which gas apparatus made by one single firm alone is serving the needs of the war, and serving it as well as—and in most cases better than—anything other than gas apparatus could do.

Knowing the unexampled difficulties in shortage of labour, shortage of material, and shortage of transit facilities, one is pleasantly surprised to find that, in-spite of all these, the Essex Works, Birmingham, is a hive of bustling activity, and not least in its furnace department. Months ago, the ordinary accommodation of the department became utterly overtaxed, and relief had to be found by making use of ample space in another part of the works, where the larger sizes of gas-furnace apparatus are now being fitted together, tested, and despatched.

Inside the department the pressure is intense and increasing. The departmental technical staff, which, as will be readily imagined, is both numerous and highly equipped, is not only closely occupied with the production of the regular standard furnace apparatus, but its members are in constant request for consultative purposes all over the country. Fresh problems, both chemical and engineering, are continually cropping-up in this


The Uses of Gas in Shell Production.
FUSE CAP. Sheet-metal annealed in Gas-heated Oven Furnace.
FUSE PLUG, SOCKET and BODY.
"NOSING-IN" TOP OF SHELL BODY.
designed Gas Furnace.
LACQUERING INSIDE OF SHELL TO PREVENT CORROSION BY ACIDS IN EXPLOSIVES.—The Lacquer is dried in Gas-heated Ovens.
BULLETS IN SHRAPNEL SHELL. Lead melted in Gas-heated Furnace.
ROSIN TO KEEP BULLETS IN PLACE
COPPER BAND SHRUNK ON TO SHELL BODY,
Oven Furnace
SOLID BILLETS USED FOR MAKING SHELLS.—These are raised in Gas-heated Furnaces
into shell form
THE SHELL BODY
BRASS SHELL-CASE. This is annealed in Gas Oven Furnace before each successive operation.
IN BORING, TURNING and SHAPING SHELL-BODIES, High-speed steel tools are used, and these are heated and tempered in Gas-heated Furnaces.
Gas-heated Mixers are used in Chemical Works connected with the manufacture of explosives.
Section of Shrapnel Shell.
Section of High-Explosive Shell.
Fig. 2.—Diagram Showing the Uses of Gas in Shell-Production.

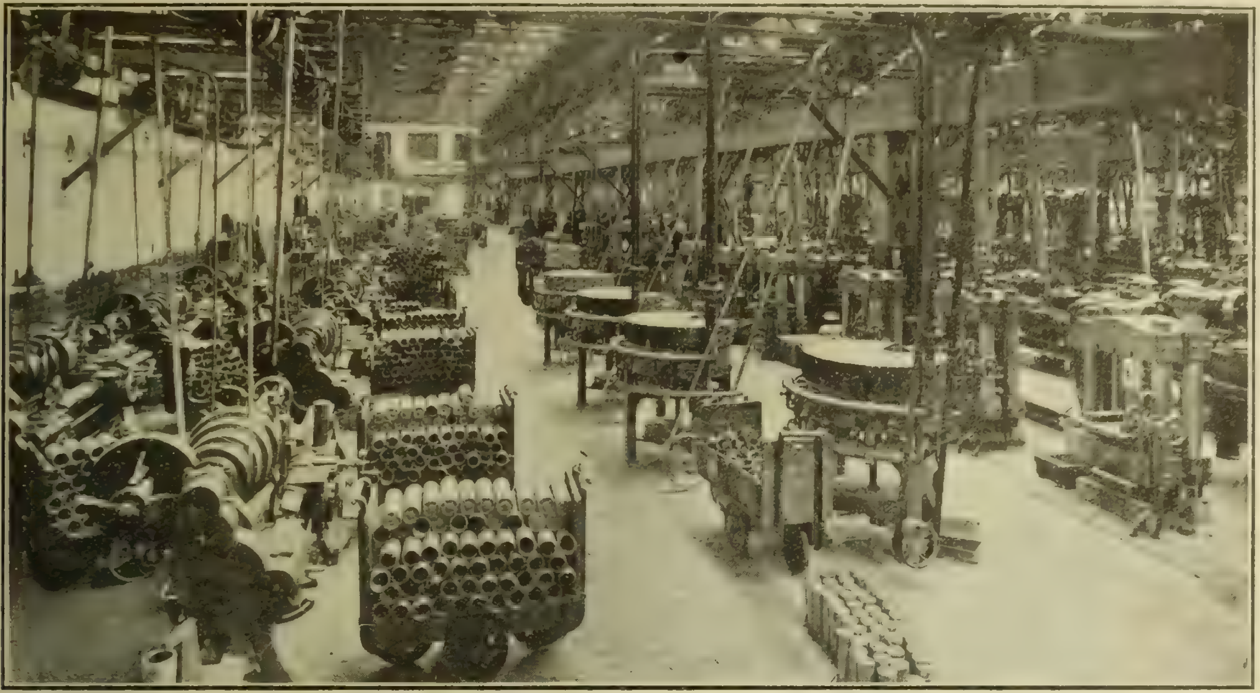


FIG. 3.—A BUSY MACHINE SHOP IN A MUNITION FACTORY.

and that munition factory. New devices have to be contrived to meet these fresh calls on the ingenuity and resource of the staff. These have never been found wanting, but have always proved fully equal to the demands of the occasion.

Projectiles of all kinds and sizes, from the small cartridges for the service rifle right up to great 15-inch shells for naval guns, owe certain of the processes of their manufacture, and often nearly all of them, to the use of gas apparatus made at the Essex Works. A walk round the works shows a great quantity of such apparatus in all stages of construction; and the total output of their gas-furnace department for war purposes is such as, we learn, would be found to be a most startling figure, were it permissible to make it known.

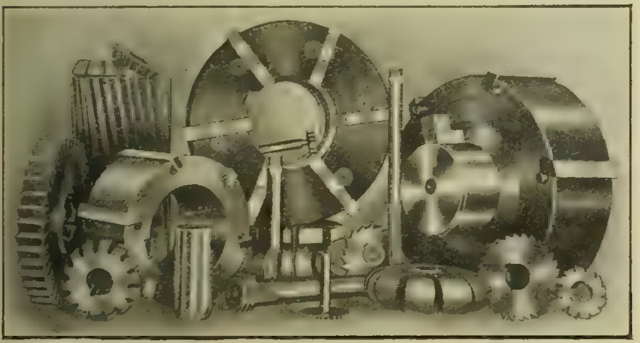


Fig. 4.—Cutters and Other Tools for High-Speed Machine-Work.

The accompanying two-shell diagram well repays examination, as an index to the pictures which follow, and, indeed, as an epitome of much of the war work which the firm's gas apparatus is accomplishing throughout the country. It is difficult to realize that so many operations are required in the turning-out of these death-dealing contrivances, and that, through the medium of the Essex Works, every one of these operations is being regularly performed by gas apparatus.

The modern shell, whether it be of the shrapnel or of the high-explosive variety, is a complex and delicate instrument, which must be made as carefully and timed as accurately as a chronometer. Wanting this accuracy, it may be too dangerous at the beginning of its journey and too safe at the end. It may kill friends; and it may fail to kill foes. A very little distortion, for instance, through the merest irregularity in one of the numerous heating processes in its manufacture, or a slight excess of hardness or softness in the encircling copper ring, due to a minute inexactitude in annealing, would affect the direction of the shell and might seriously damage the gun. A very slight flaw in some part of the fuse might mean that the shell would burst too soon, or that it would not burst at all. In respect of its contribution towards the avoidance of such irregularities, gas heating, with its steady uniformity of action and effect, is the obvious perfection of means adapted to ends; and the Essex Works shell-furnaces have been so contrived for conserving every advantage of this uniformity, that it is small wonder no shell manufacturer who can get them—whether in Government factory or private works—will be content with other furnaces employing cruder fuels.

The uses of gas in this connection do not, however, end with the shell—indeed, it may be said that they do not begin with it either. Let the reader picture a vast and splendidly equipped shell-manufacturing establishment, such as the representative factory "Somewhere in Britain," which is shown in fig. 3—the firm's rotary gas-shell furnaces will be seen prominent in the fore-

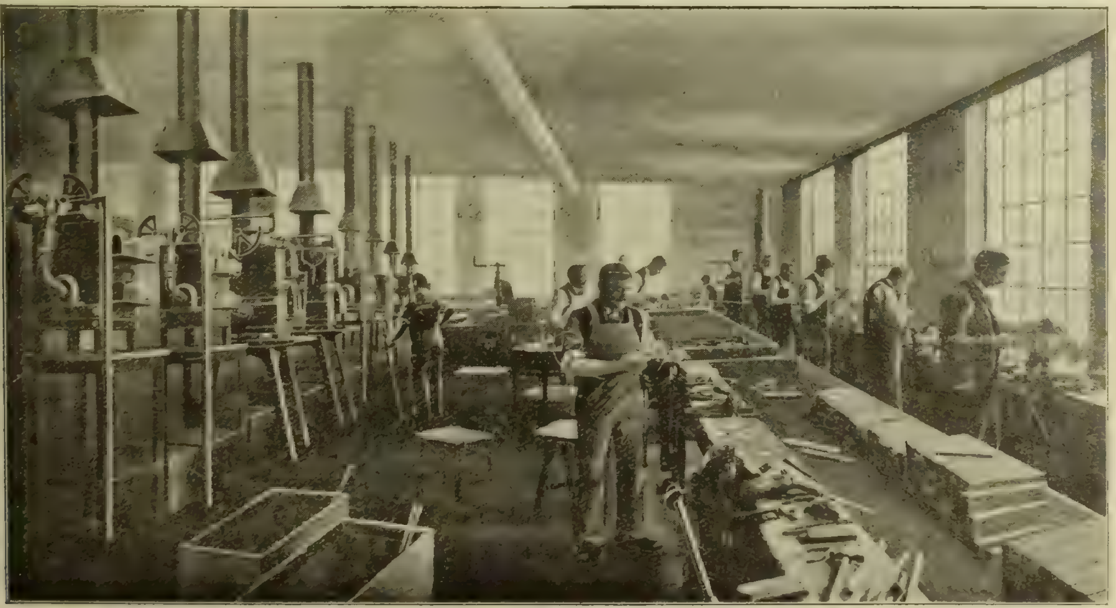


FIG. 5.—A BATTERY OF HIGH-SPEED-TOOL GAS-FURNACES IN POSITION IN A MUNITION FACTORY.

ground—and let him ask himself what must happen with all the fine high-speed tools that are in use in such a factory, as after regular wear and tear, they from time to time require restoring to working condition.

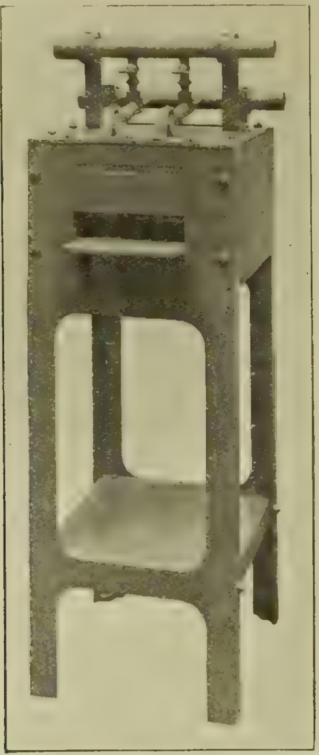


Fig. 6.—A Gas-Forging Furnace for Some Classes of Munition-Making Tools.

In the hands of the toolmakers, who may be called the ambulance corps of the army of munitioners, those vast numbers of tools which are rendered temporarily *hors de combat* are, by the use of Wright-Brayshaw high-speed-tool gas-furnaces, speedily restored to the ranks of the effectives once more. Indeed, some of the largest makers of munitions in the kingdom have standardized on the firm's high-speed-tool furnaces—just as some gas undertakings do on their gas-stoves. These munition makers buy the furnaces from the firm in batches; and they highly value the reliable uniformity and other great conveniences resulting from their standardizing on this one make of apparatus.

Fig. 6 illustrates a gas-forging furnace such as is used in the earlier processes in the career of certain classes of tools. In these furnaces, to begin with, the metal of which the tools are to be formed is heated, in order that the preliminary operation of shaping may be carried out.

Coming to brass cartridge cases, the furnaces in which these are annealed are by no means small or light; and it illustrates the huge scale upon which everything in this war is conducted that these furnaces should actually be commonly referred to in dozens. One large munition firm, for example, has fitted up about three dozen of the firm's gas annealing furnaces, specially designed for annealing the cartridge cases for the Army-service rifle; and with the help of these they are turning out many millions of cartridges every week.

We remarked that in the Essex Works furnace apparatus gas was doing much war work better than any other fuel; and a most interesting example of this betterment is the heating of cartridge clips for the rifle cartridges to which reference has just been made. In large munition works it has been found that Wright's 6-ft. by 4-ft. gas-furnaces take $33\frac{1}{3}$ per cent. more cartridge clips (twelve boxes instead of nine) as compared with a coal-fired furnace of similar size. This is due to the uniformity of temperature which the gas-furnace maintains. In the coal-fired furnace, owing to what is termed "cold-mouth" of the furnace, the boxes of clips could not be placed within 18 inches of the door—a restriction which is entirely done away with in Wright's gas-furnaces. These gas-furnaces also reduce the time that the clips have to spend in the furnace by a further $33\frac{1}{3}$ per cent.; so that between these two savings the output is almost doubled. Another point scored by the gas-furnaces is that three of them occupy only the same space as one of the coal-fired variety, with its indispensable coal-storage space, which is not called for with gas. Hence these munition makers have actually multiplied their output on the same floor-space six times over by installing Wright's gas-furnaces.

Fig. 7 shows pictorially the sixfold economy effected by gas in the treatment of cartridge clips.

Fig. 8 is a photograph showing, in position in the munition works, the gas-furnaces which have superseded the coal-furnaces in the manner described. These same furnaces are also used for the annealing of sheet brass for munition purposes, as well as for annealing cartridge clips.

In fig. 9 is shown one of the "Glory-Hole" furnaces, as they are called in munition works, which the firm supply for use in connection with the "nosing-in" process as applied to the largest sizes of shells, from the 3·3-inch and 4·5-inch up to the 15-inch. This particular furnace actually heats, at one charge, four of the huge 15-inch shells which have done so much to maintain the supremacy of the British Navy. The illustration strikingly brings home to one how effectually gas is helping the war at sea as well as on land.

A "Glory-Hole" Furnace used for "nosing-in" smaller shells in munition factories is shown in fig. 10. The hydraulic press with which the actual "nosing" is done, after the nose of the shell has been heated in the furnace, appears at the left-hand side of the photograph.

Another process in shell manufacture is the lacquering of the interior, in order to prevent the metal being corroded by the chemical action of the explosive materials with which it is filled. The lacquer having been applied, the shells are placed in ex-

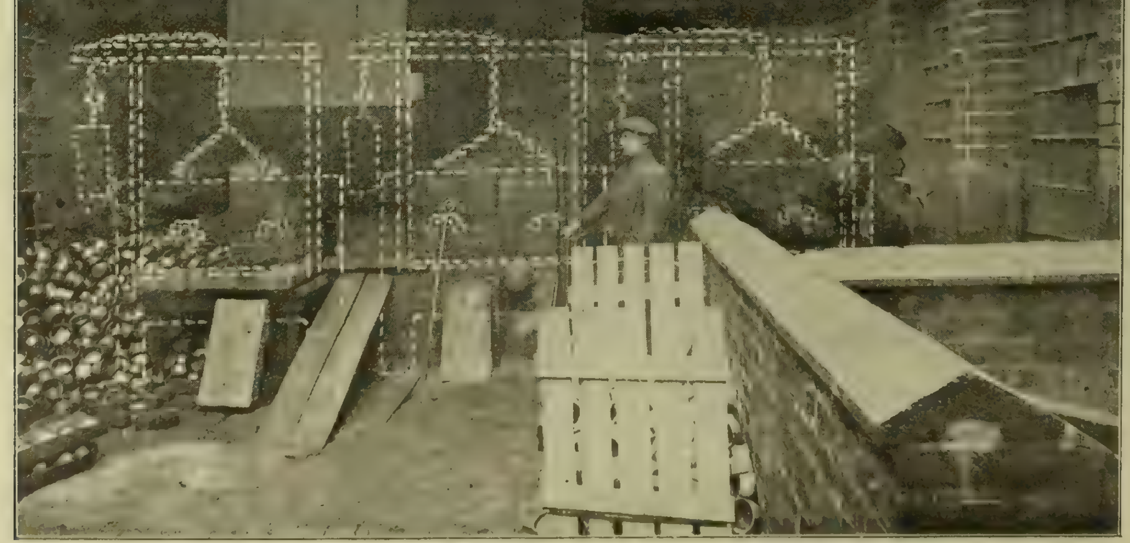


FIG. 7.—SHOWING HOW GAS-FURNACES DO SIX TIMES THE WORK OF COAL-FURNACES.

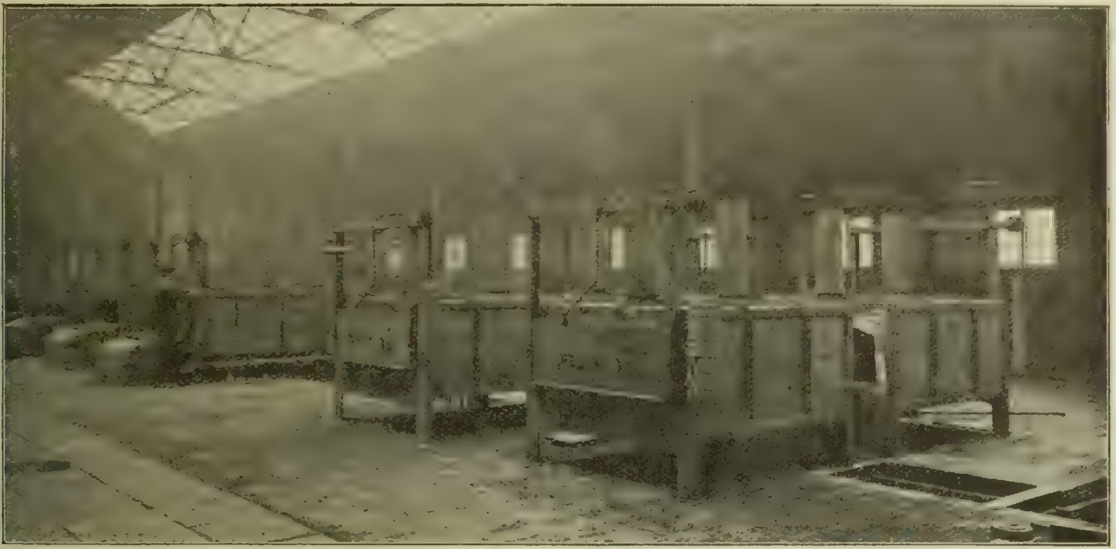


FIG. 8.—THE GAS-FURNACES THAT HAVE SUPERSEDED THE COAL-FIRED TYPE.

ternally-heated gas-ovens for drying. Fig. 11 shows one of the Essex Works gas-furnaces being used for lacquer drying, with four 15-inch shells in the trolley. The presence of the workman indicates how enormous these shells are.

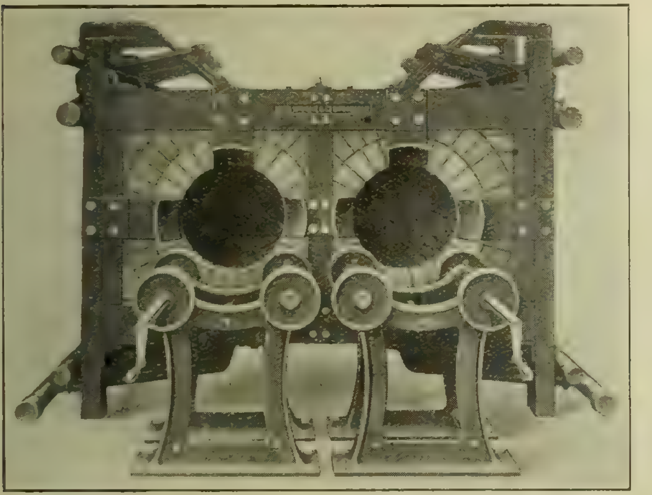


Fig. 9.—A "Glory Hole" Nosing Gas-Furnace for Fifteen-Inch Naval Shells.

Great importance is attached at the Essex Works to the various types of crucible furnaces in which the firm have specialized. These are of all sizes, and capable of smelting from the smallest quantities of metal up to a very heavy daily melt.

Messrs. John Wright and Co. early recognized the exceptionally great possibilities of industrial gas apparatus of the crucible-furnace type; and exceedingly large as their business was in that class of apparatus, they believed that in the then existing types there were certain inherent limitations which must be got rid of before gas melting-furnaces could generally take the place of the coke-fired variety. Due experiment and research produced their present form of crucible furnace, which is now in so wide use, and with which metal can be melted so economically that the cost of the day's run does not exceed 2 to 3 feet of gas per pound of metal melted. It is also found that the life of both the crucible and the furnace is greater with this apparatus than with the coke-fired furnace, and that the loss of metal due to oxidization is considerably less than half that which is inseparable from coke firing.

Fig. 12 shows one of the applications of the firm's crucible furnaces to shell manufacture, in which fourteen of their crucible tilting furnaces and a battery of thirty of their fixed crucible furnaces are installed in one shop in a munition factory, melting white metal for shell fuses. The amount of metal melted by this installation of gas-furnaces in a day is over two tons. Owing to it being found impossible to get Government permission to reproduce the photograph originally intended for this particular portion of the article, we show an installation of thirty furnaces and fourteen tilting furnaces under one roof, but with an altered background, so as to prevent the surroundings being recognized.

Messrs. Wright and Co. supply a type of gas-heated lead bath (fig. 13) which is used for a heating-up process in the manufacture of certain types of shells.

Brass tube of various sizes is naturally in use for an equal variety of purposes in the manufacture of munitions; and for the annealing of these tubes a special gas-furnace has been designed and supplied by the firm, as illustrated in fig. 14, in order to give absolute uniformity of annealing the entire length of the tube.

Fig. 15 shows a gas-furnace which has been specially made for tempering the entrenching tools with which certain sections of our Army are now furnished.

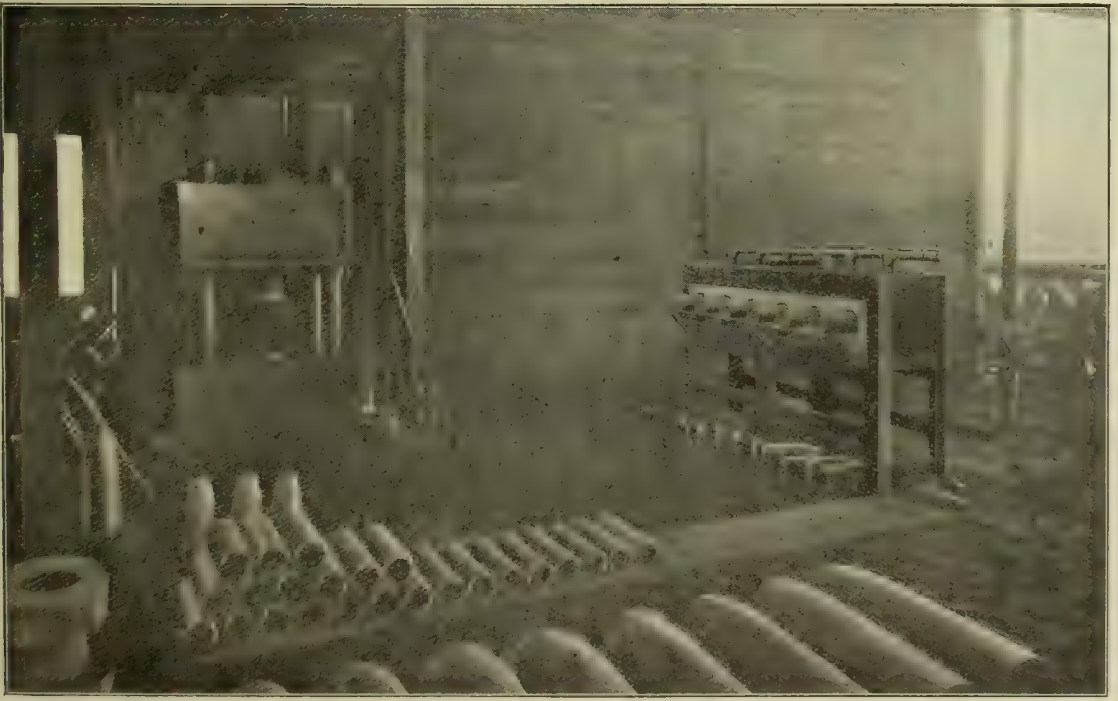


FIG. 10.—A SMALLER TYPE OF NOSING GAS-FURNACE IN POSITION IN A SHELL-FACTORY.

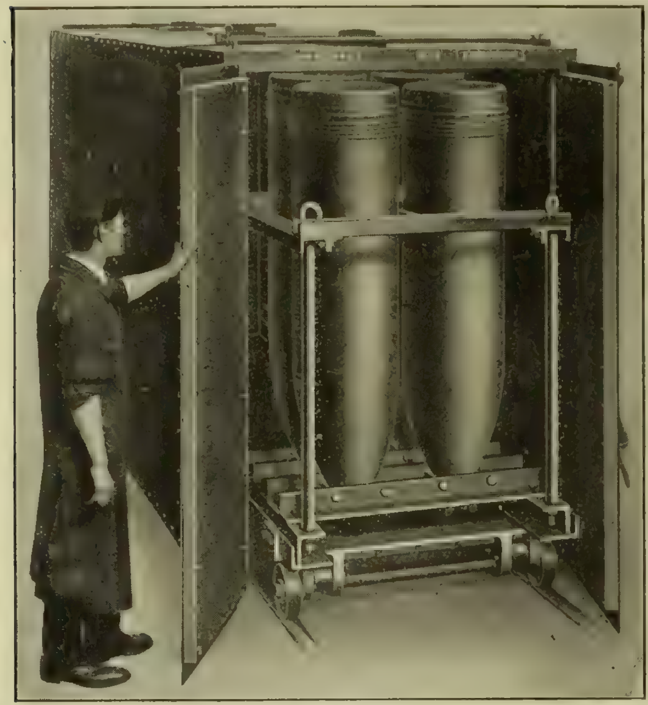


Fig. 11.—Fifteen-Inch Shells entering the Gas-Heated Lacquer-Drying Furnace.

War uses of the Essex Works furnaces are by no means confined to the manipulation of metals. Furnaces of suitably modified construction have also gone from this establishment to glass manufacturers for processes in connection with glass apparatus for war purposes.

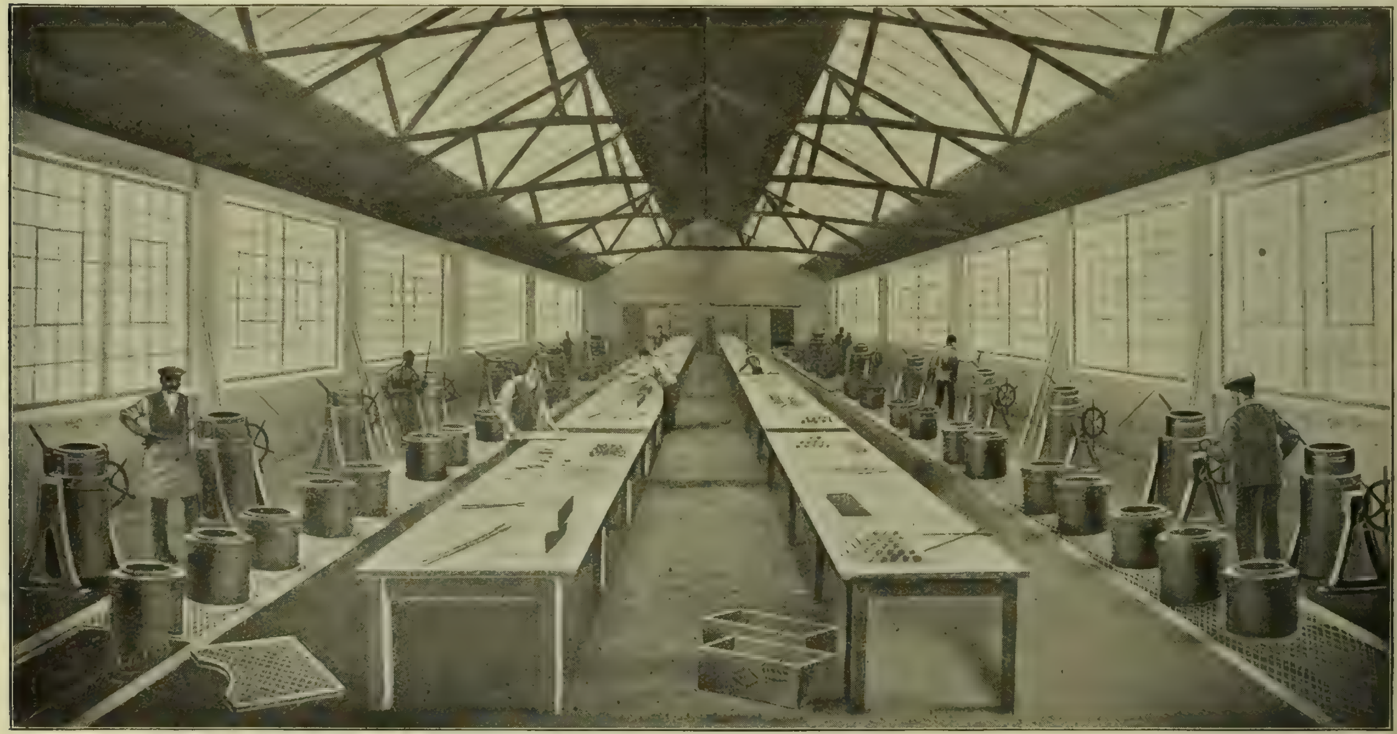


FIG. 12.—A BATTERY OF GAS CRUCIBLE-FURNACES—FOURTEEN TILTING AND THIRTY FIXED—AS INSTALLED IN A LARGE MUNITION FACTORY.

The large machine which is being handled by a workman in fig. 16 is one of a number which Messrs. Wright and Co. have supplied for use in chemical works, in connection with the manufacture of explosives for munitions. The apparatus consists of a very large gas-heated vessel (having agitator machinery inside) for the mixing of certain materials connected with these explosives. There being such a dearth in the labour market at present, work in operating this machine is minimized by its being so constructed as to tilt over to the side for emptying purposes.

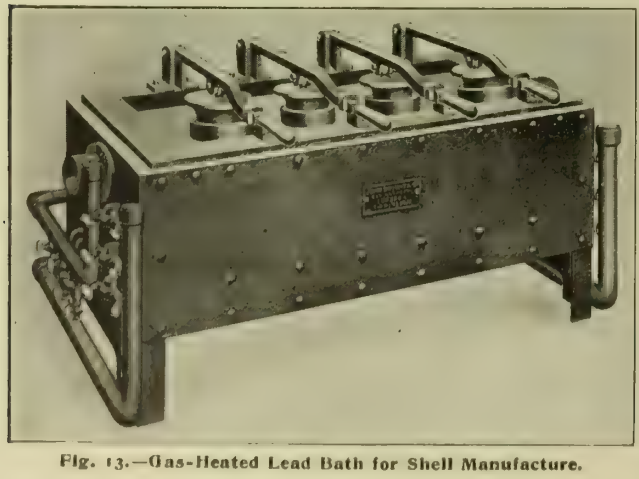


Fig. 13.—Gas-Heated Lead Bath for Shell Manufacture.

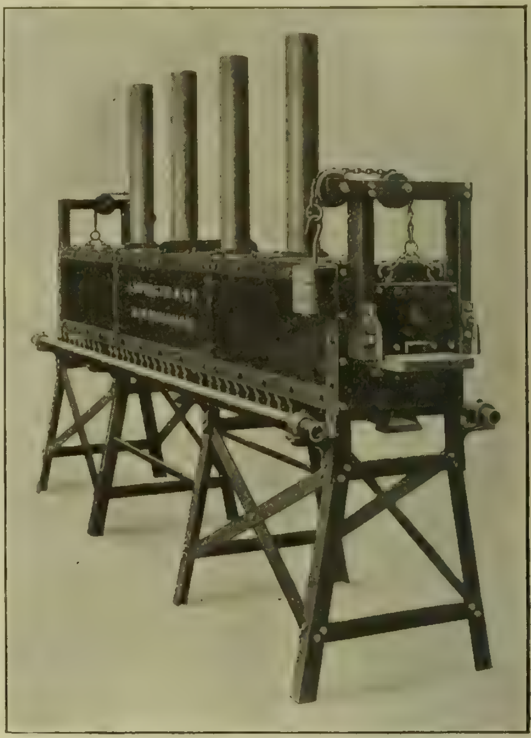


Fig. 14.—Annealing Gas-Furnace for Brass and Copper Tube.

It has been remarked that Essex Works war apparatus has not been confined to the treatment of metals, and, indeed, it is by no means limited to facilitating the production of contrivances for damaging the enemy. Apparatus not less effective is also being furnished from the same works for promoting the creature comfort of our own soldiers. The sudden converting of the whole country into one great Arsenal involves the erection of brand new munition factories and the conversion and extension on a large scale of existing factories. For the great concourse of additional workers with which these vast, newly-equipped munition factories are being manned, means have to be improvized for the supply of meals, as in many cases no such arrangements exist. Here, again, the variety of gas-cooking apparatus which the Essex Works are in a position to furnish has been recognized as offering facilities of the most elastic kind for every varying scale of need; and for the supply of such requirements this section of the firm's establishment has been kept working at high pressure since a very early period of the war.

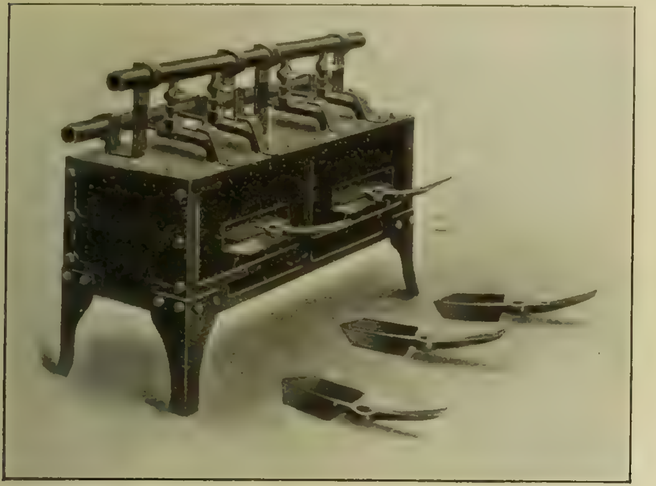


Fig. 15.—Furnace for Tempering Entrenching Tools.

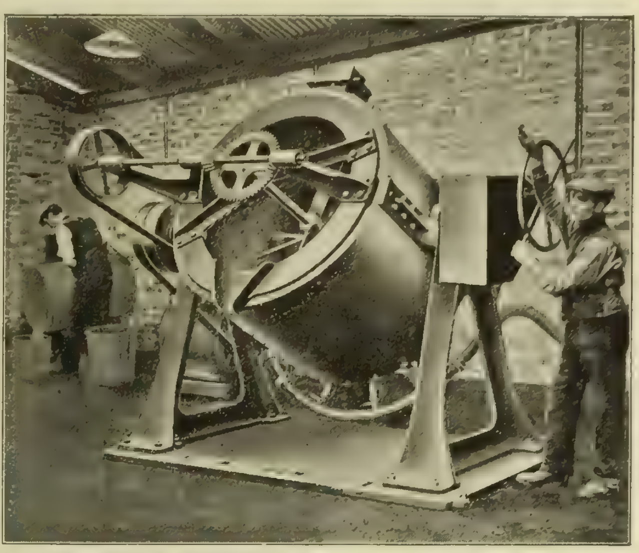


Fig. 16.—Gas-Heated Tilting Mixer for Explosives.

While we are dealing with the matter of kitchens, fig. 18 may also be referred to, as illustrating similar provision for the wants of soldiers in camp, in the shape of a camp kitchen which has been fitted with suitable apparatus from the Essex Works.

Recounting on the fingers of one's hand, so to speak, the salient points of what has been ascertained from a most instructive review of the Essex Works war apparatus, we find that the munition-making tools are prepared and repaired by the help of gas-furnaces; the shells at nearly every process are treated by gas-furnaces; the rosin and lead for the bullets for filling the shells are melted by gas; the lacquer inside them is dried by gas; trench tools, with which our men "dig themselves in," are tempered by gas; the camps where they live, and the hospitals where they convalesce, are heated by gas; the food they eat is cooked by gas; and the very uniforms they wear are not free from obligation to the all-round utility of the same medium.

In short, whether the material to be treated be mineral or vegetable, or whether, indeed, it be animal in the shape of food, gas is proving itself to be the most convenient medium for the purpose; and when we add to this the fact that the gas industry is providing one of the most essential of present-day war materials, gas men of all varieties have every reason to feel that gas never more fully vindicated its high place in modern industry than it is now doing in the great war.

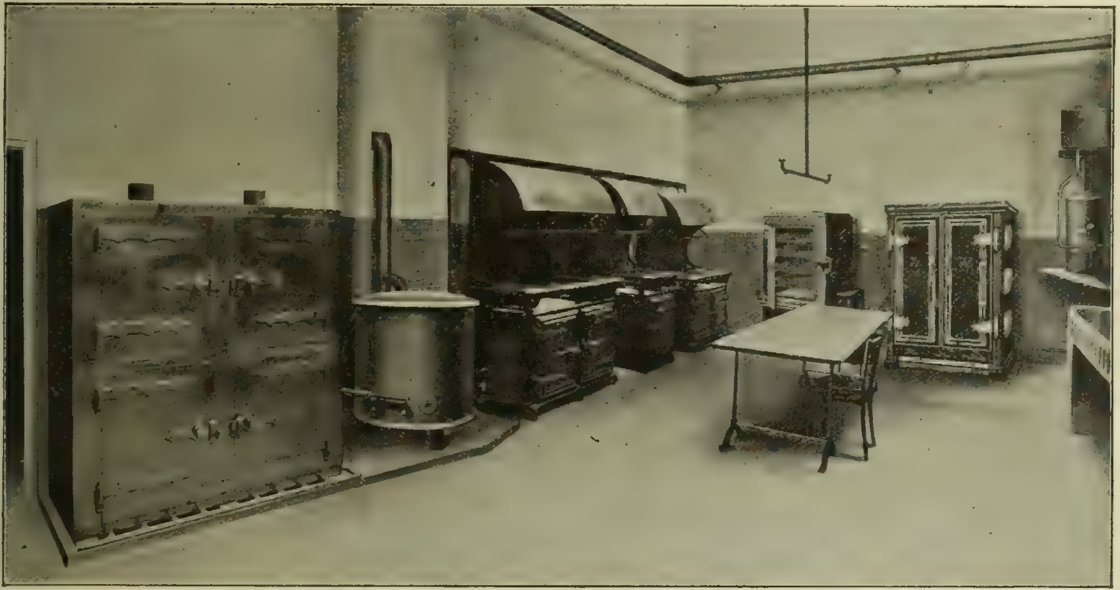


FIG. 17.—KITCHEN OF A MUNITION FACTORY, WITH GAS APPARATUS THROUGHOUT.

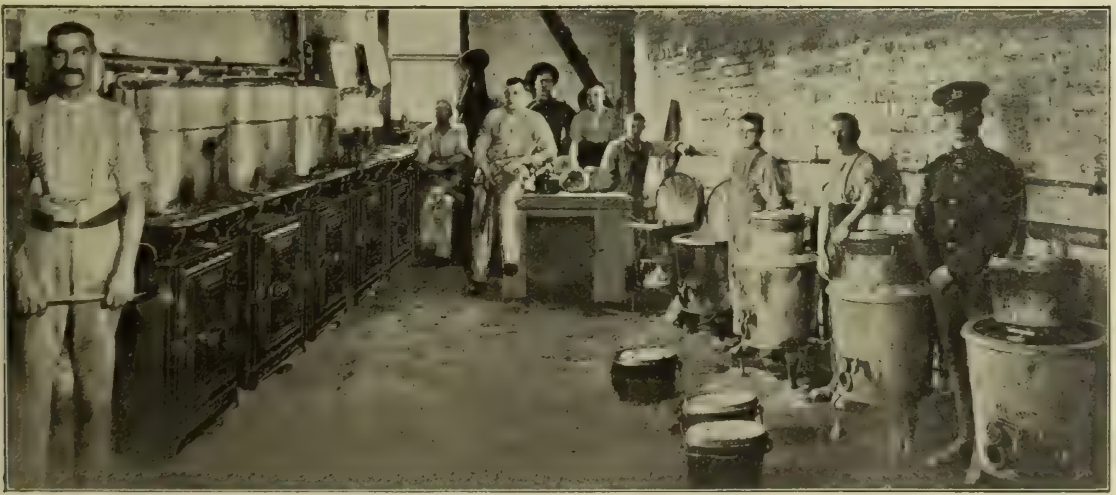


FIG. 18.—KITCHEN OF A MILITARY CAMP, ALL THE APPARATUS IN WHICH IS GAS-HEATED.

BYE-PRODUCTS OF CARBONIZATION.

By Burton Dunglinson.

Shortly after war was declared, industrial Britain began to realize how much she was dependent on German commodities, particularly artificial dye-stuffs. Then came the explosives question, and the maintenance of an adequate supply of high explosive shells, for a rapidly increasing army. These two problems were tackled in a businesslike manner; and, thanks to our engineers and scientists, we now find ourselves in a position of security, with only the problem of raw material to trouble us.

Most dye and explosive factories are dependent on their regular supply of benzol and toluol; but I wonder how many gas engineers and coke-oven managers are acquainted with the treatment meted out to their tar and benzol before it is placed on the market as an explosive or dye-stuff. I do not propose to disclose works secrets, but to provide a short résumé, dealing with the building-up of an explosive and dye, using tar as a starting point.

When the tar arrives at the distillation works, it is usually placed in a large stock tank, where it is pre-heated, and so freed from excess water before entering the still. The first runnings of the distillation (light oil) are collected as one fraction, boiling between 40° C. and 150° C. This oil, contains most of the benzene and toluene, but requires special treatment before being despatched to the explosive manufacturer. The fraction above the light oil, known as carbolic or middle oil, is worked for phenol. This is recovered by washing the oil with a weak caustic soda solution; and subsequent decomposition of the sodium salt, with either carbonic acid or dilute sulphuric acid, yields phenol. This liberates the phenol *plus* cresols, which are separated by fractionation, and the former is then concentrated. Although the supply of phenol recovered in this manner is ample for the world's requirements in normal times, owing to the enlarged demand in war time the quantity of natural phenol is insufficient. This insufficiency necessitates the adoption of other measures to provide supplies to meet the demands, and synthetic phenol is brought forward.

Before any military explosive can be manufactured, the pure, raw product must be obtained; and our attention is diverted to the manufacture of pure benzene and toluene. The conversion of the crude material into the various commercial products is ordinarily effected by rule-of-thumb processes, devised without any adequate preliminary study of the nature of the compounds dealt with, and without recognition of the scientific principles by which the manufacturer should be guided. Crude benzol contains a host of impurities, all of which are detrimental to the manufacture of a good explosive; and these must be eliminated previous to the isolation of the pure compounds. The impurities commonly met with are appended below, with their approximate percentage in a crude 65's benzol. The yield of unsaturated, aromatic, and paraffin hydrocarbons can be estimated in the following manner, devised by Drs. Dunstan and Thole, from various mixtures of paraffins, benzene, toluene, hexamethylene, and olefines of known composition, and the results agreed to 1 per cent.

Estimation of Unsaturated Hydrocarbons.

For this purpose, 50 c.c. of the crude benzol is shaken with about 20 c.c. of 95 per cent. H_2SO_4 for two minutes and allowed to stand for ten minutes, when the decrease in volume is read. This represents the amounts of unsaturated bodies.

Estimation of Aromatic Hydrocarbons.

The unattacked portion from the above experiment is treated with 25 c.c. of fuming sulphuric acid, containing 20 to 30 per cent. of SO_3. This must be done cautiously, as considerable heat is generated, and cooling may be necessary. After shaking for ten minutes, allow to stand until separated, and the decrease in volume is again noted. This represents the yield of aromatic hydrocarbons. Paraffins and hexamethylenes are unattacked by these acids, and are therefore estimated by difference.

Composition of Crude 65's Benzol (approximate).

	Per Cent.		Per Cent.
Unsaturated bodies . . .	1·0	Thiophene	0·5
Aromatics	90·5	Mercaptans and thio-ethers .	0·5
Paraffins, &c.	3·0	Hydroxy-compounds . . .	2·5
Carbon disulphide	2·0		

The crude benzol is usually treated with 98 per cent. C.O.V. to remove the greater proportion of the impurities. The orthodox method on the Continent is to fractionate the light oils into essential components, and wash afterwards. In small works, it is customary to wash the whole of the crude benzol, and fractionate later. The reactions with concentrated sulphuric acid are very complex, but are of interest, and perhaps altogether new to some readers. Where the oil is treated with caustic soda first, some of the sulphur compounds are dissolved, and all the phenol and homologues recovered.

Thiophene (C_4H_4S).

This has a specific gravity of 1·07 and boils at 84° C. It greatly resembles benzene; and on treating it with concentrated sulphuric acid forms a brown solution, containing a sulphonic acid. This slowly decomposes, forming H_2S,SO_2, and an amorphous precipitate of free carbon.

Unsaturated Bodies (C_nH_{2n}).

These include ethylene and its homologues, dihydrobenzenes, and tetrahydrobenzenes. Concentrated sulphuric acid forms an additive body—a sulphonic compound, which is soluble in the benzol, and therefore requires thoroughly washing out with water after acid treatment.

$$C_nH_{2n} + H_2SO_4 = C_nH_{2n+1}OSO_2OH.$$

These bodies react with violent evolution of heat, and this increase of temperature tends to sulphonate the aromatics; hence the importance of adding the acid in small quantities, where these compounds are present in appreciable amount.

Aromatics are only slightly attacked by concentrated sulphuric acid; but the reaction is more rapid at the higher temperatures. Paraffins and hexamethylenes are unattacked by sulphuric or fuming acid. Carbon disulphide is not attacked by sulphuric acid, but is suitably removed by agitation with alcoholic potash, which forms potassium xanthate.

$$CS_2 + C_2H_5OK = C_2H_5O.CS.SK.$$

Mercaptans and Thio Compounds—R.SH and $(R)_2S_2$.

The mercaptans present in crude benzol are probably ethyl, propyl, and phenyl, with a possibility of the higher homologues in small quantities. The mercaptans have slightly acid properties, and are readily oxidized, forming the thio-ether. Cold sulphuric acid does not dissolve these sulphides, but, on warming, sulphur dioxide is given off.

Phenyl mercaptan has a boiling point of 168° C., and on adding concentrated sulphuric acid, forms a violet solution, changing on warming through red to blue. It is readily oxidized to thiophenol. Most of these compounds form the sulphones, which are soluble in the aromatics left behind; and therefore a good water washing, after acid treatment, is desirable to eliminate them, as they yield sulphur dioxide on heating. The benzol is treated with caustic soda solution before passing to the still for fractionation. When testing benzols in the laboratory, and cooling is resorted to, to prevent sulphonation, an emulsion is often formed on shaking up with water, after acid treatment. The emulsion is the result of surface tension, and can often be broken by adding a drop of ethyl alcohol, which causes a change in the affinity and less cohesion. A crude 65's benzol will yield on the commercial scale, with an efficient column and dephlegmator and careful distillation, about—

40	per cent.	benzol	containing nearly	3	per cent.	toluene.
25	,,	toluol	,, ,,	90	,,	,,
8	,,	solvent naphtha	,, ,,	5	,,	,,

Previous to the benzol being worked on the large scale, it should be valued in the laboratory; and here we find difficulty in obtaining similar conditions to the commercial methods, chiefly in the column, which always lacks the dephlegmator. I have made experiments with various columns, and find that the majority are inefficient, and all would be improved if worked in conjunction with a small spiral condenser on top of the column. The amount of water flowing through the condenser can be regulated to give the requisite temperatures for a complete fractionation. Where this cannot be used, lagging the column with an asbestos shield for the higher fractions is very helpful. Laboratory results give the total yields of products obtainable, together with working losses; and these are sometimes difficult to obtain from the commercial scale figures.

Experiments with Different Columns.

Number of Fractionations Necessary for the Complete Separation of Benzene and Toluene.

Young and Thomas twenty-bulb "Rod and Disc" .	10
Gan's (Galician column)	8
Le Bel Henninger five-bulb	7
Young's "Evaporator," three-bulb.	3

In the above experiments, 1 litre was used and distilled at one drop per second, collecting in 5 c.c. fractions. On a commercial scale, the rate of flow is about 3 per cent. by volume of the charge per hour; and if the plant is efficient, two fractionations are quite sufficient to separate the pure benzene and toluene.

Manufacture of Synthetic Phenol.

The benzene needed for this product must distil over between 80° to 82° C., and should only contain just traces of sulphur compounds, as these substances interfere with the sulphonation and subsequent fusion. The process is completed in about eight stages, and if done in the laboratory an electric motor and stirrer is invaluable—the operation taking only about four hours, against twelve hours when shaken by hand. The benzene must be free from all impurities, which decompose with sulphuric acid, otherwise the product will darken, due to the forming of free carbon and resinous bodies. These decompose the acid, with evolution of sulphur dioxide at high temperature.

Sulphonation.

The reaction here is: $C_6H_6 + H_2SO_4 = C_6H_5SO_2OH + H_2O$. Excess acid must be added to absorb the water formed, and two parts of C.O.V. to one part of benzene by weight is usually sufficient. The amount is comparatively large, as its affinity for water is determined by the evolution of heat on reacting with it. The curve produced jumps up rapidly on the addition of the first few per cent. of water, but settles down to a gradual incline after this point. The first operation consists in running the acid into the sulphonation pan or kettle, and the benzol is added later on. The kettle is connected to a return condenser, and the contents agitated by means of revolving blades. The temperature of the mass rises, and is maintained at about 80° C. by means of steam passing through an outer jacket. The sulphonation is usually finished in about six hours, and care should be taken to stop at the correct time, and so prevent the formation of benzene disulphonic acid. If too much acid has not been used, the crystals of the benzene mono-sulphonate settle out on cooling. The resulting compound is run into water, and converted into the calcium salt by milk of lime.

$$2C_6H_5SO_2OH + Ca(OH)_2 = Ca(C_6H_5SO_2O)_2 + 2H_2O$$

The excess of sulphuric acid combines with the calcium hydroxide to form calcium sulphate; and this is recovered by filtration. The liming operation is followed by means of litmus paper, and when the mass is nearly neutral calcium carbonate is used to finish the reaction. The soluble calcium salt is recovered by means of filter presses, and is then converted into the sodium salt by means of soda ash. The point at which no more soda ash should be used is determined by the absence of a precipitate, when a small amount is added. The precipitated calcium carbonate can be used for neutralizing the sulphonation mixture.

$$Ca(C_6H_5SO_2O)_2 + Na_2CO_3 = 2C_6H_5SO_2ONa + CaCO_3$$

The solution of the sodium salt can be evaporated by any suitable means; and before alkaline fusion it must be perfectly dry. The yield of the sodium salt is about 90 to 95 per cent. The salt is now ready for alkaline fusion, when the sulphonic radicle is replaced by the hydroxyl group. This is usually done in an open boiler or pot, with suitable stirring gear. If the operation is performed in the laboratory, an ordinary wrought-iron blank coupling suffices; and the melt is stirred by means of a hollow glass tube, sealed at one end and containing a little mercury, with the thermometer just dipping in the mercury. Care should be taken in stirring, as the caustic soda "spits." Also the temperature must be regulated very carefully; for too low a temperature gives no reaction, and too high a temperature decomposes any phenol formed. The caustic is melted first, with the aid of a little water. When the temperature approximates to 250° C., the sulphonate is added, and the temperature gradually raised to 300° C.—the higher limit being 320° C.

$$C_6H_5SO_3Na + 2NaOH = C_6H_5ONa + Na_2SO_3 + H_2O.$$

Excess of caustic is always used, in quantity three to four times the sulphonate, by weight. The melt is generally complete when bubbling stops and the liquid becomes thin. If a great excess of caustic has been used, a separation into two layers takes place, and can be distinguished by the different colours of the sodium phenolate and caustic. The resulting mass is dissolved in water, and the phenol liberated by means of dilute sulphuric acid, CO_2, or HCl. The phenol is separated, and air blown through to free it from sulphur dioxide. The resulting mixture is now fractionated in a still with a column so as to separate the cresols, which boil at 188° to 200° C.; while the phenol boils at 182° C., and the pure product melts at 42° C.

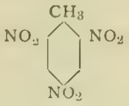
Picric Acid.

Picric acid is tri-nitro-phenol; and the next problem is to introduce these three nitro groups into the benzene nucleus. This cannot be accomplished in one operation, and picric acid can be made either from phenol or dinitrobenzene as a starting point. The first method consists in nitrating phenol sulphonic acid, keeping the temperature at about 15° C. while running in the acid, and gradually increasing it to about 80° C. toward the end of the operation. The mixture must now be kept away from all except the precious metals; and after diluting with water the crystals separate out—being only slightly soluble in water. The second method uses dinitrobenzene as the starting point. This is chlorinated to dinitrochlorbenzene, and the chlorine atom replaced by heating with caustic soda, and then further nitrated to picric acid. Picric acid, as manufactured commercially, is a reddish yellow, large crystal, containing traces of dinitrophenol. It is supplied to the shell filling factories with about 10 per cent. of moisture, and is fused into the shells. It is usually detonated with mercury fulminate.

Trinitrotoluene.

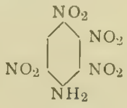
There is practically no information regarding the large scale preparation of "T.N.T." in either British or Continental literature, although no secret is made of the materials used. T.N.T. requires a very pure toluene for its manufacture, and when distilled through a column flask, no more than 0·5 per cent. should come over at 110° C., and all distil over at 111·5° C. The reason why such a pure toluene is necessary is justified when explosive values are being calculated. If a small percentage of benzene is present, nitrobenzol is formed, which dissolves the T.N.T., and so prevents a sharp crystallization. The nitration of toluene is generally conducted in two operations—either the mono- or di-derivative being formed first. A mixture of sulphuric acid and water *plus* nitric acid is made, in the proportion of 6 : 1 : 2 by weight. This is added to the toluene in the proportion corresponding to one molecule of nitric acid to one molecule of the toluene.

The mixture is agitated by means of a motor and suitable stirring gear, and heated to 80° C. for about three hours. The M.N.T. is separated, and a mixed acid, made of 15 parts of 98 per cent. C.O.V. to 4 parts of concentrated nitric acid, is added. One part of the M.N.T. is used to 7 parts of the mixed acid, and the temperature is gradually raised from 70° to 120° C. in three and a half hours, and then kept at 120° for two hours or longer, as the setting point of the T.N.T. necessitates. This should be 82° C., and is tested by withdrawing a small quantity of the nitrating mixture and throwing it into water while stirring rapidly. The T.N.T. separates out and can be dried, and a setting point determination carried out. The acids are run off while still hot, and the T.N.T. is led into water and stirred vigorously to free it from acid. After allowing to settle, it is again washed with water and finally recrystallized from alcohol. T.N.T., when it is pure, is a colourless, crystalline compound, with a melting point of 81·5° C.; but it is usually slightly yellow in colour. Although heat is not liable to explode it, it is advisable, when dealing with this material, to melt it in hot water. T.N.T. must pass stringent tests, both chemically and physically, before it is used for shells. It must have a sharply-defined melting and softening point, a small percentage of ash, with a limited acidity. It is generally melted, and filled into shells, in order to increase its specific gravity. It has the formula:



Tetra-nitro Aniline.

This was discovered by Dr. Flurscheim, and has the unique position among explosives of having been discovered in this country. It is less sensitive than picric acid, and offers many advantages as an explosive. A good detonator is prepared by using a mixture of T.N.T. and T.N.A. It is prepared by the action of concentrated sulphuric acid and a nitrating agent upon metanitraniline; the latter substance being made by reducing *m*-dinitrobenzene with H_2S in ammoniacal solution. One part of *m*-nitroaniline and three parts of a nitrating agent are dissolved in 36 parts of concentrated sulphuric acid, and the mass heated to 70° C. Cooling is now applied, to prevent further rise of temperature, after which the mixture is heated to 100° C. for a few minutes, and tetranitroaniline isolated by pouring on ice. It is recrystallized from nitrobenzene, and has a melting point, with decomposition, at 216° to 222° C. It is a golden crystalline substance, and has the formula—



Dyes.

In manufacturing synthetic organic dyestuffs, a large number of products obtained from coal tar are used as raw materials; but our work is limited to benzene and naphthalene as the starting points. When benzene is nitrated at about 60° C. mononitrobenzene is formed, and this, on reduction, yields aniline. Aniline was discovered in 1826 by Unverdorben, and was one of the dry distillation products of natural indigo. It was isolated from coal tar by Runge; but it was only prepared by reduction of nitrobenzene in 1842. The commercial preparation consists in reducing nitrobenzene by means of iron filings and HCl in a closed vessel. While reduction is proceeding, great heat is evolved; and this necessitates the use of a condenser leading back to the still, to condense the volatilized aniline water. When the reduction is completed, the acid is neutralized with lime or caustic soda and the aniline recovered by steam distillation.

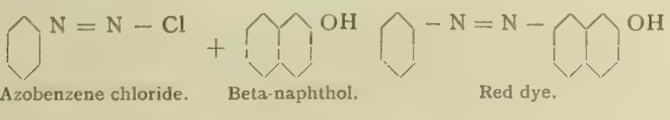
It is a colourless liquid when pure, and boils at 182° C. On treating the salt of a primary aromatic amine with nascent nitrous acid, the diazo-compound is formed. The salt of the primary aromatic amine may be made by adding HCl to the aniline, and either isolating and redissolving or leaving it in solution. The aniline "salt" is now "azotized" with HCl and sodium nitrite, using three or four equivalents of the acid. The temperature must be kept very low; and after the HCl is added in bulk the sodium nitrite must be added very slowly, while still maintaining the temperature at 0° C. and stirring constantly.

$$C_6H_5NH_2 + HCl = C_6H_5NH_2 . HCl.$$

$$C_6H_5NH_2 . HCl + NaNO_2 + HCl = NaCl + 2H_2O + C_6H_5 . N = N . Cl.$$

If the diazotized chloride is now "coupled" with either a phenol, naphthol, or an amine, a dye is formed. Using naphthol (beta) in alkaline solution, a red dye is produced on stirring with the above azobenzene. All quantities must be calculated from molecular weights, excepting where other directions are given. The red dye, called azobenzene-beta-naphthol, is recovered by filtration and dried in a steam oven, when it is powdered fine and mixed with sodium sulphate and other diluents to bring it to the "commercial standard"—*i.e.*, give a particular shade to a cloth on time exposure.

The following equation illustrates the formation of the dyestuff—



Azobenzene chloride. Beta-naphthol. Red dye.

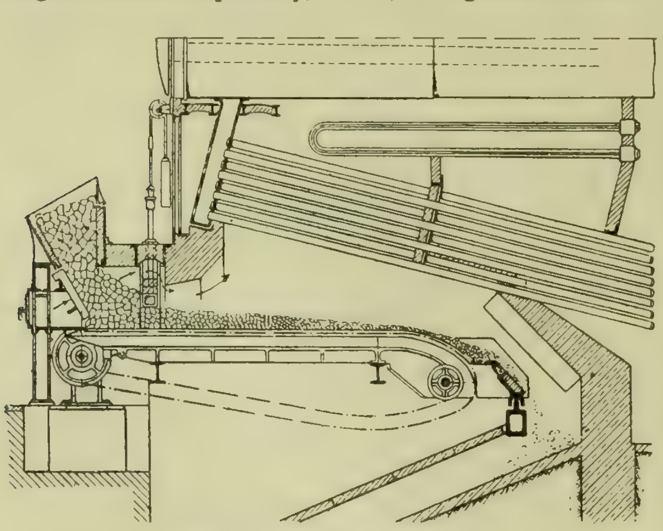
Naphthalene Derivatives.

If naphthalene is treated with concentrated sulphuric acid, in the presence of a little mercury as catalyst, phthalic acid is formed, which is dehydrated and yields phthalic anhydride on distilling at a temperature of 300° C. This substance sublimes in beautiful, white, needle-like crystals, and on heating with a little phenol and concentrated sulphuric acid phenol phthalein is produced, which is well known in the laboratory as an indicator; yielding a purple colour in alkaline and a colourless one in acid solution. If the anhydride is heated with resorcinal (di-hydroxy-benzene), fluorescein is formed—a dye which gives a fluorescence in water, with reflected light. Fluorescein itself is not a good dye-stuff; but its halogen derivatives—such as the bromide and the iodide—are of considerable value.

COKE AS A BOILER FUEL IN GERMANY.

The "Electrical Review" last week, Dec. 31, had an interesting article on this subject—pointing out that, owing to the shortage of labour (probably as much potential as actual), and the closing of various foreign markets, energetic measures have been taken in Germany to prevent the possibility of a serious coal famine, and to utilize coke which would normally be exported. These measures have attained a considerable degree of success; and from various reports it appears that a number of German electricity supply stations are using coke for boiler-firing.

Where a mixture of coal and coke is used, no particular trouble is experienced, beyond that of obtaining and stoking a reasonably uniform mixture of the two fuels; but the use of coke alone is a less simple matter—particularly if machine stokers be employed. It is impracticable to break and grade coke so that it can be used satisfactorily in sprinkler stokers; while if it be attempted to use coke alone on a travelling grate, the difficulty is to ignite the gas-free fuel as it enters the combustion chamber. Normally, heat from an incandescent arch of refractory material over the point of entry of the fuel, frees gases from the latter; and these gases burning with a long flame keep the arch hot, and thus render the whole action of ignition continuous, once it is started. With a fuel like coke, free from volatile gases, this action fails, and the fuel ignites late and imperfectly, if at all, as the grate advances.



Section of Coke-Burning Furnace.

An ingenious method by which this difficulty has been overcome is shown in the accompanying illustration [from "Zeitschrift der Verein Deutscher Ingenieure"]. The lower part of the coke-feed hopper is lined with refractory bricks, and fitted with an inclined grate at the front, and a flue at the back leading into the combustion chamber of the boiler. There is thus formed a hopper furnace, which preheats the fuel above it, and brings it to incandescence before passing it on to the travelling grate. The greater part of the heat which is not usefully employed in this direction passes beneath the boiler, and is there utilized. This equipment, which is due to Belani, of Essen, is said to have been tested with satisfactory results on a water-tube boiler in the Düsseldorf Elektrizitätswerke, though, owing to some mishap during the coal-firing tests, all that could be established was that the results with coke firing were more favourable.

Other tests—this time on a boiler with an ordinary horizontal grate—showed that coke may be literally a better fuel than coal of higher thermal value. The heating surface was 1680 square feet, and a flaming coal of 13,000 B.Th.U. calorific value raised 3·4 lbs. of steam per hour per square foot of heating surface, or 6 lbs. per pound of coal. On the other hand, coke of 12,600 B.Th.U. per pound (size ranging from dust to 2¾ inches) raised 3·8 lbs. per square foot of heating surface, or 6·6 lbs. per pound of coke. The highest measured combustion chamber temperature and the flue gas exit temperature were respectively 1220° and 376° C. with coal, and 1145° and 473° C. with coke.

The paradoxical superiority of the coke is due to its requiring a smaller surplus of air for combustion and suffering no loss from unconsumed gases or tar. On the other hand, it must be remembered that the preceding data evidently refer to anything but a modern high-power boiler; and no mention is made of the relative costs of coal and coke as boiler fuels. This is at present of minor importance to Germany as compared with the fact that her surplus coke supplies can be used—staving off the possibility of a fuel famine, and permitting full military advantage to be taken of the bye-products of coke manufacture.

AMERICAN COMMERCIAL GAS ASSOCIATION.

Convention at Washington.

Judging from issues of our American contemporaries which are now coming to hand, the recent Washington convention (the eleventh annual gathering) of the National Commercial Gas Association of the United States was an all-round success. The President was Mr. H. B. M'Lean, of New York; and he delivered an address (in the presence of over 300 delegates) in the course of which he dealt with various matters of importance to the Association. The lines of work prosecuted were also indicated in the report of the Board of Directors. The following officers for 1916 were unanimously elected:

President.—Mr. Jansen Haines (Des Moines).
First Vice-President.—Mr. Arthur Hewitt (Toronto).
Second Vice-President—Mr. W. Griffin Gribbel (Philadelphia).
Third Vice-President.—Mr. W. W. Barnes (New York).
Treasurer.—Mr. Oscar H. Fogg (New York).
Secretary & Assistant Treasurer.—Mr. Louis Stotz (New York).
Directors.—Messrs. J. B. Myers (Philadelphia), S. T. Willston (Brooklyn), B. J. Kellum (Chicago), C. R. Stull (Kingston), T. M. Ambler (Brooklyn), C. A. Munro (Chicago), H. L. Schutt (Philadelphia), R. R. Young (Newark), C. E. Babcock (San Francisco), and C. L. Holman (St. Louis).

There was an excellent exhibition of gas appliances in connection with the convention; and on three days of the week during which the meeting was held, no morning session was arranged, so as to allow members ample opportunity to inspect the appliances on view. Not only was there plenty of business to be done, but a programme of entertainments was organized, for both members and lady visitors, which reflected the greatest credit on those who prepared it.

Here is a list of the reports and papers which were presented.

Directors [Report]	
Treasurer [Report]	Mr. W. J. Clark
Finance Committee [Report] . .	Mr. W. H. Pettes
Amendments to Constitution [Report]	Mr. W. J. Clark
Public Policy [Report]	Mr. E. N. Wrightington
Membership [Report]	Mr. T. M. Ambler
Company or Local Sections [Report]	Mr. W. W. Barnes
Manufacturers' Section [Report] .	Mr. W. M. Crane
Address of the President . . .	Mr. H. B. M'Lean
Nominating Committee [Report] .	Mr. P. S. Young
Time and Place Committee [Report]	Mr. Arthur Hewitt
"Selling Gas Service"	Mr. George Williams
"The Principles of Merchandising as Applied to Gas Service . . .	Mr. Joseph H. Appel
Publicity Committee [Report] . .	Mr. J. M Brock
Advisory Committee to the President [Report]	Mr. O. H. Fogg
Standardization of Gas Appliance Specifications [Report] . . .	Mr. O. H. Fogg
Advisory Committee on Exhibitions [Report]	Mr. B. J. Kellum
Reciprocal Relations with Other Associations [Report]	Mr. J. D. Shattuck
Illumination Committee [Report] .	Mr. R. ff. Pierce
"Theory and Design of the Injector as Adapted to the Blast System of Gas Burning"	Mr. W. C. Buell, jun.
"Theory of Lighting"	Mr. C. O. Bond and Dr. Ives
"Fundamental Principles of Good Lighting"	Dr. P. G. Nutting
Educational Control [Report] . .	Dr. Lee Galloway
Salesman's Handbook [Report] .	Mr. C. Edwin Bartlett
Accounting [Report]	Mr. A. P. Post
International Committee on Commercial Advancement [Report] .	Mr. Arthur Hewitt
Domestic Fuel Appliances [Report]	Mr. L. F. Blyler
Development of Industrial Fuel [Report]	Mr. S. Tully Wilson
Central Development Bureau [Report]	Mr. R. C. Ware
Heating, Refrigerating, and Ventilation [Report]	Mr. Geo. S. Barrows
Differential Rates [Recommendations of Committee]	Mr. P. S. Young

The selection of the place of next meeting was left to the officers, though New York City was tentatively decided upon.

CAST-IRON PIPE-JOINTS.

Preliminary Report of the Committee of the American Gas Institute.

In a "foreword" to their report as published in the "American Gas Institute News," the "Committee on Cast-Iron Pipe-Joints" say they wish it to be expressly understood that no portion of it is necessarily final. The object in allowing the publication of the report in this form is to endeavour to secure the most extended criticism, the necessity for which is made clear in the body of the report. The members of the Committee state that they are not in entire agreement upon all the suggestions made in the report.

INTRODUCTION.

The fact that cast iron has an indefinite life underground, under normal conditions, has led to its use for carrying gas and water. The disadvantages of cast iron for gas-work have been its fragility and the difficulty in making positive joints. It may be expected, however, that cast iron will continue to be used until an alloy of steel is developed which will give a certain life equal to cast iron at no increased cost.

The subject of proper joints to use for cast iron has been the cause of a great deal of experiment, the data of which have never been presented. It has also been discussed frequently in technical sessions and in papers without any definite conclusions. At present, engineers are using various kinds of joints, largely depending on their own opinion or the opinions of their subordinates. It was on the belief that it would be possible to standardize practice, that the Committee was appointed.

THEORY OF THE JOINT.

For many years pipe-joints were made of lead backed with some form of packing, usually tarred or untarred jute. The lead was cast in place and subsequently caulked. About twenty-five years ago the cement joint was introduced, and came into use extensively; but as far as the Committee have been able to learn there was no scientific theoretical reason for adopting this joint. It was tried, found satisfactory and durable, and gradually came into more frequent use, until at the present time it is being used for small mains under normal conditions by practically every gas company in the country.

The use of cement joints was extended to larger mains with apparent satisfaction. Later developments, however, have brought up strongly the question of the advisability of cement joints for large main-joints. At the present time opinion is divided, as is discussed later in the report.

Cast-iron main-joints may be divided into two classes. First, the rigid joint, in which no possible movement could take place at the joint without leakage. Second, the flexible joint, in which slight movements may take place without leakage. To the first of these classes belong the cement joint, welded joint, bolted flange joint, and the one or more forms of special bolted iron-to-iron joints. To the second belong lead joints, lead-wool joints, combination lead and cement joints, joints with special impregnated packing, and all the various types of joints made-up of special clamps with elastic gaskets.

For a rigid joint to be successful, the change in temperature of the main underground should not exceed an amount which will produce stresses in the pipe greater than the strength of the joint. It is not difficult to arrive at changes in underground temperature due to seasonable changes in temperature, and from this calculation the probable stress set up in the pipe by such change. In the calculations made by the Committee, the modulus of elasticity for cast iron was taken at 15,000,000; the coefficient of expansion, 0·00000556; and the ultimate tensile strength of cast iron, 20,000.

A bar of cast iron rigidly held at both ends is stressed to its ultimate tensile strength by a change of temperature of about 240°. The underground changes in temperature may be expected never to exceed 50°. Therefore, it may be said that cast-iron pipe has a safety factor of approximately 5 under these conditions; and any joint which will be and remains more than 20 per cent. as strong as the pipe will be theoretically satisfactory.

There are no experimental data sufficiently elaborate to specifically give the strength per square inch by contact between the cement and iron in a cement joint; but even in the absence of experimental data, the Committee have sufficient data from practical experience to draw fairly safe conclusions.

Cement joints in small mains, 4-inch and 6-inch, have been in use in a number of locations throughout the country with entire satisfaction for over twenty years. This would seem to be sufficiently long to make certain their dependability for small mains. For large mains the cement joint has not proved entirely satisfactory. Theoretically, this is not unexpected. There seems to be no logical reason for making a rigid joint of a given strength and not increasing the strength when making the similar joint in large mains where it is quite obvious that the stresses will be increased. The point of the matter is that if satisfactory 4-inch cement joints in standard "A. G. I." bells are properly designed for strength, then, as the strength depends on the area of the bond between the cement and iron, it is obvious that no joint larger than the 4-inch is strong enough. Of course, there is no justification in assuming that 4 inches is the standard, or that it is too strong, and, therefore, the larger joints are strong enough. But as stated before, in this discussion the Committee have had the practical experience of a long life in 4-inch cement joints.

In all the other types of rigid joints, the large first cost has inhibited their extensive use. There is no reason to believe, however, that a rigid joint in a cast-iron main of any size would not be satisfactory; and if such a joint can be designed at practical cost, there would seem to be no reason for not adopting it.

The lead joint has been used for many years, and has usually resulted in small leakages at the joint sooner or later. Based on the fact that there is probably a very slight movement taking place at each joint, the Committee would expect this result to follow. The lead-wool joint is an advance in art, by the substitution of prepared lead wool for cast lead. It is advanced only in the fact that the complete compression of the lead ring can be assured, which, of course, is only true if the packing is compressed sufficiently hard to form a rigid backing for the lead. On this theory, the combination joint of packing cement and lead has come into use extensively within the last two years. The theory of this joint is that the rigid cement ring effectually maintains the alignment, and provides a solid backing against which to caulk the cement. It is not maintained by its advocates that this joint is rigid. It is thought that the same slight movements probably take place; but because of the method of making, which insures a more efficient joint, these movements will be so slight as to postpone leakage for an indefinite time.

There has not been sufficient time elapsed since these combination joints have been extensively used to determine whether they are going to be permanently satisfactory or not. The longest time in which combination joints are known to have been used is about nine years in large mains with entire satisfaction. These were combination cast lead and cement joints in a 20-inch line.

Another type of flexible joint consists of a packing impregnated with some material insoluble in gas; the joint being packed solidly with this material, leaving room in front for a ring of lead or cement to act as a gland. The theory of this joint is that the packing acts as the packing in a stuffing-box, allowing the slight movements to take place, but remaining permanently tight. This theory seems to be sound; but it must be borne in mind that the packing is not placed between machined surfaces, but simply between the rough castings. Further, it is well known that expansion joints which are carefully made of machined fittings, and carefully packed, leak at intervals, and must be taken up. It is not urged that this is a fair analogy, but there does seem to be some similarity. In this type of joint also sufficient time has not elapsed to prove them effective.

Of the various types of clamped joints on the market, a number have proved satisfactory in so far as the design of the clamp was concerned—the failures being confined to the rubber gasket which was used exclusively until the last two years. These rubber gaskets had proved satisfactory through long service for natural gas. They have failed in a large number of cases in comparatively short service with artificial gas. Whether the substitution of the soft core fabric gaskets will remedy the trouble cannot be predicted. Theoretically these joints will eventually leak for the same reason that one might expect any other so-called flexible type joint to leak. The elasticity of the material will probably disappear, or the jointing material will be abraded sufficiently to allow small leaks.

CURRENT PRACTICE.

When starting upon its work, the Committee were familiar in a general way with the current practice of joint-making; but, in order to ascertain as far as possible the practice of the representative plants in the country, a brief series of questions was sent to seventy of the larger companies. A copy of these questions is attached to this report. Several interesting conclusions have been drawn from the fifty-eight answers received. A brief summary expressed in percentages follows:

	Low Pressure up to 10-inch Water.		Medium Pressure, 10-inch Water up to 5 lbs. Gauge.
Use standard bell and spigot pipe	94	..	94
Use extra depth of bell	6	..	6
Cement joints in small mains	62	..	53
Cast-lead joints in small mains	29	..	30
Lead-wool joints in small mains	9	..	17
Cement joints in large mains	29	..	25
Cast-lead joints in large mains	49	..	45
Lead-wool joints in large mains	15	..	19
Combination cement and lead	7	..	11
Size where line drawn between large and small mains, average (inches)	11·5	..	10·8
Small joints satisfactory—per cent. of total	98	..	97
Small lead joints unsatisfactory—per cent. of used	12	..	15
Small cement joints unsatisfactory—per cent. of used	0	..	0
Large joints satisfactory—per cent. of total	73	..	72
Large cement joints unsatisfactory—per cent. of used	53	..	67
Large lead joints unsatisfactory—per cent. of used	10	..	19
Large lead-wool joints unsatisfactory—per cent. of used	0	..	14
Large combination joints unsatisfactory—per cent. of used	0	..	0
Companies having tried some special form of pipe	29	..	*
Special joints satisfactory	35	..	0
Special joints unsatisfactory	65	..	0

* Not enough reported to give statistics.

Of the companies reporting, 65 per cent. used cast iron for medium pressure. Only 7 per cent. used cast iron for high pressure, or not enough to present data until further development by correspondence or investigation, for which there has not been time.

Care should be taken in drawing any final conclusions from the summary; but the Committee believe that there are certain strong tendencies in current practice which are clearly shown, and which may be taken to indicate in a general way what the distribution engineers of the larger companies are doing.

A table of this kind prepared (say) three years ago would not have shown any combination joints being used. The fact that there are no reports of failures of the combination joints is significant, but should not be taken as conclusive as yet, as sufficient time has not elapsed to determine their ultimate value.

The high percentage of large cement joints reported unsatisfactory is also significant. This does not mean, of course, that there was this percentage of failures. In fact, there is nothing in the reports to indicate any total failures. The conditions are probably that the cement joints in large mains are not satisfactory to the responsible engineers, and a strong effort is being made to improve the joints or substitute a more satisfactory type.

It will be noted that not by any means all the companies are using cement joints in small mains. The reasons for using lead wool in some locations are known to the Committee; but why any engineers are still using cast lead in small main joints under normal conditions is interesting, and should be developed further by correspondence.

A study of the summary indicates, however, that the large majority of engineers are thoroughly satisfied with the cement joint for small mains; and the Committee do not hesitate to recommend the cement joint in standard "A.G.I." bells for small mains, but do not feel that there are sufficient data at hand at this time to specifically set the limit of size over which the cement joints in standard bells would not be satisfactory. There has been prepared, therefore, a specification for cement joints, which embodies what the Committee believe to be the best practice.

SPECIFICATIONS FOR CEMENT JOINTS.

1. The efficiency of a cement joint depends on filling the clean joint with the maximum quantity of the proper quality of cement properly mixed.

2. In the "A.G.I." standard depth bells cement joints should only be made up to and including 8-inch mains.

3. In 10-inch and over cement joints should preferably be made in deeper bells, the depth of which should be not less than that given in the following tables:

Inches.	Inches.
10 to 5	20 to 6¾
12 ,, 5½	24 ,, 7½
16 ,, 6¼	30 ,, 8½

4. Mains of 4, 6, 8, and 10 inches may be laid on the ditch bottom; 12-inch and over on blocking.

5. The spigots and bells must be clean and free from all loose material. Dirt and scale must be removed with wire brushes and scrapers. Tar or any substance of an oily nature may be removed with gasoline, but must be subsequently scrubbed with soap and water and rinsed thoroughly with clean water. Clean bare iron is absolutely necessary.

6. The ditch must be levelled to a true bottom, and the bell-holes dug. The pipe must be entered, pushed home, and lined-up without entering any packing whatever in the joint—thus departing from the old practice, in small mains, of using the back-packing to lift and enter the spigot into the bell, and then driving-up the back-packing to space the joint. With a properly bottomed ditch, the joints will be very nearly spaced when the pipes are entered and lined-up.

7. In 4-inch, 6-inch, 8-inch, and 10-inch mains the joints must be spaced with wedges—see A, fig. 1.

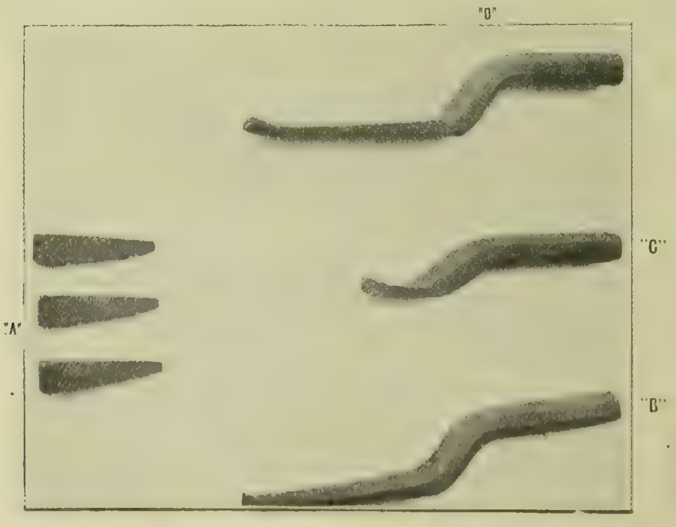


Fig. 1.—Caulking Tools and Wedges.

8. Tap in lightly two of the wedges at about the two lower thirds of the circumference of the pipe, and the third wedge at the top. Sliding the fore-fingers around the joint is a simple and accurate method of determining if the joint is properly spaced. Sufficient wedges should be provided to allow laying as many pipes as desired before joint-making.

9. Cover and tamp the pipe firmly into place between the bell-holes. The tamped earth covering has two important functions: (1) It holds the pipe firmly in place for the joint-making; (2) It maintains the pipe at a much more uniform temperature during the progress of joint-making and subsequently than would be possible if exposed to the atmosphere.

10. Use untarred jute packing, dry and free from oil in the bales.

11. The back-packing must be wet with clean water, and thoroughly wrung-out by twisting into a tight rope. The wet rope of packing must have a uniform diameter of from 7/16 inch to ½ inch. Do not grout the packing. The rope of packing should be of such length as to reach once around the spigot and lap 1 inch.

12. Remove the wedges and enter the packing. If the spigot has a bead, use the yarning iron shown at B, fig. 1, driving the yarn into the wedge-shape recess formed by the bead on the spigot and filet on the back of the bell, as shown in fig. 2. Use a 4 lb. caulking hammer for all cement joint work. If the spigot is cut, use the yarning iron shown at C, fig. 1, which will compress the yarn as shown in fig. 3.

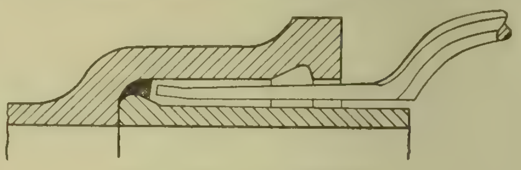


Fig. 2.—Packing Tool "B."

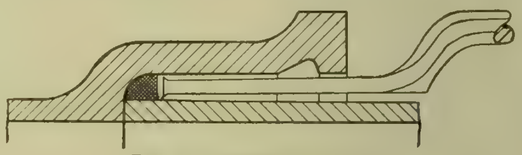


Fig. 3.—Packing Tool "C."

13. The cement should be a high-class medium setting American portland cement, must be in perfect condition, and must all be passed through a No. 50 screen before mixing. Mix thoroughly by hand to a consistency of a stiff putty in such quantity that all will be used within 15 minutes after mixing. Discard any mixed longer than this time. Mix in the shade.

14. With a small trowel fill the joint with cement flush with the face, then use a ½-inch cotton rope slightly longer than the circumference of the pipe and drive in the cement with the caulking tool shown at D, fig. 1. Withdraw the rope and fill the joint flush with the face with cement. Wet and twist a piece of yarn that will be of uniform diameter of from 9/16 inch to ⅝ inch when twisted tightly. Drive this yarn into the bell with wide face caulking tool D.

15. The making of the joint must proceed continuously; there being no lapse of time between the successive operations.

16. Point the face of the joint with cement so that it is smooth and flush with the face of the bell. Fig. 4 shows a section of the finished joint.

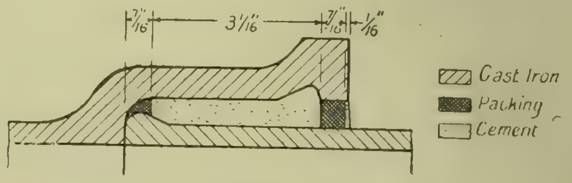


Fig. 4.—Section of Finished Joint.

17. Do not make joints until the pipe has assumed approximately the temperature of the ground. If the sun shines in the ditch, shield the pipe exposed in the bell-holes from the direct rays of the sun. This becomes increasingly important as the size of the pipe increases.

18. Test the joints with soap and water under gas pressure. If the mains are intended to carry any higher than the usual low gas pressures, test them with air pressure and soap suds at twice the pressure that the system is laid to carry. When testing with air at high pressures the test should not be applied until the joints have been made 24 hours or longer; and the greatest care must be used to avoid temperature changes in the pipe while waiting for the test.

19. The above method should be followed in the 4-inch, 6-inch, 8-inch, and 10-inch mains. For mains 12 inches and over (mains 10 inches and over must have special depth bells for cement joints), the same procedure as for mains 10 inches and under should be followed, with the following exceptions and additions.

20. After bottoming the ditch to a true line, wood blocks are set in front of and behind each bell, and carefully and solidly em-

edded so that the top surface is the true plane of the bottom of ne pipe. After laying the pipe and entering, the joints are spaced y wooden wedges on the blocking.

21. With bells 6 inches and over in depth, after driving the ement in with the cotton rope and withdrawing the rope, the oint must again be filled with cement and again driven in with he rope ; then filled again with cement, and the front packing ntered.

22. For mains 20 inches and over, the rope of back-packing ust be from $\frac{9}{16}$ inch to $\frac{5}{8}$ inch in diameter, and the front-packing rom $\frac{5}{8}$ inch to $\frac{3}{4}$ inch in diameter.

23. Increasing care must be used to maintain uniform tempera-ire of the pipe as the size increases. Especial precautions must e taken to assure that there is practically no difference in tem-eratures between the top and bottom of the large pipe.

COMMENTS ON SPECIFICATIONS.

This specification has already been submitted to a number of istribution engineers; and the Committee have incorporated the riticisms that have been received. Also where the specification eparts from current practice the reasons for the practice selected ill be given.

[The numbers refer to the paragraphs of the specifications.]

1. This is based on the assumption that the cement joint is a igid joint, and that its strength depends on securing most inti-nate contact between the cement and iron of the bell and spigot nd filling the lead ring with cement. If the cement joint is not rigid joint (which is incredible), then the amount of cement vould still be an important factor, because it is obvious that the arger the area of contact the less likelihood there would be that ne leakage would be serious under low pressures.

2 and 3. The Committee have purposely not made these para-raphs imperative because of the fact that in a few instances ement joints in large mains, as large as 20-inch and over, have een satisfactory in standard bells. There is, therefore, no justi-cation for condemning the practice ; but in face of the evidence f the dissatisfaction that has been reported, the Committee do ot feel justified in recommending that the cement joint be made n the large mains in standard bells.

4. The large majority of engineers do not use blocking when aying mains in undisturbed ground. Either small mains are aid directly on the ditch bottom, or, where abnormal conditions xist, a special design is made. For mains 12 inches and over the locking is used for joint-spacing as described under paragraph 8. The following schedule of blocking and wedges is suggested :

	Size of Blocking.			Size Distance Pieces.			Size of Wedges.		
ize of lains. nches.	Thick-ness. In.	Width. In.	Length. In.	Thick-ness. In.	Width. In.	Length. In.	Thick-ness. In.	Width. In.	Length. In.
12	3	12	18	1	12	12	2	5	8
6–20	3	12	24	1	12	24	3	5	12
4–30	4	12	30	1	12	24	3	5	12

5. It would be possible to elaborate this paragraph, but the Committee believe it is sufficiently complete, particularly with the inal sentence—that clean bare iron is absolutely necessary.

6. This is the first radical departure from the current practice, and was purposely adopted because the fundamental idea of this specification is expressed in the first paragraph ; and in order to nsure having the maximum quantity of cement in the joint, it is necessary to insure having the minimum quantity of packing equired to insure a satisfactory joint. With the current prac-ice of lifting the spigot by the back-packing, there is certainly a endency toward having this packing unnecessarily thick and often unnecessarily long.

7 and 8. The carrying of the spigot on wedges tapped into the oint is not a new idea—having been used heretofore in making arge main joints by a number of engineers. It is introduced here for the reasons given under 6. The additional labour adds very little to the cost of the joints. This was determined by actual experiment. It is one of the points selected by the Com-mittee to insure better joint-making. A number of comments have been made on it, to the general effect that the operator has not found the practice necessary. This is not denied by the Com-mittee; but the use of the wedges in small mains has been the practice in several locations, and has undoubtedly proved advan-tageous, and will certainly be an improvement, where the joints are undertaken by more or less inexperienced operators.

9. This paragraph is self-explanatory, but a brief discussion may be made here in regard to the effect of temperatures in lay-ing mains with cement joints. Small mains have been laid with cement joints, when the atmosphere was below freezing point, with entire satisfaction. It is obviously necessary under these condi-tions to take additional protective measures; but the Committee feel that this is a matter of common sense and judgment on the part of the operator, and needs no specific recommendation in discussing the subject of cement joint making.

10. In ordering jute packing, the specification should state, "Dry and free from oil." But as a matter of fact, jute packing supplied by the trade will never be entirely free from oil or tar. A very small amount is not detrimental.

11. Here is a second departure from current practice, as the majority of engineers do not wet the packing. It has been found by experiment that wetting the packing has several advantages. In twisting it into a rope, it can be made tighter, and is comparatively free from projecting strings. In other words, it makes a smooth tight rope, as compared with a loose fuzzy rope when dry packing is used. It will pack more solidly into the bell, and when finished will have a more uniform front surface than dry packing. This was determined by actually driving the back-packing into split bells, which were subsequently taken apart and examined. It is also highly probable that a very dry packing does actually inhibit the setting of the cement in immediate contact with it. This was also tried in a split bell ; and the cement in contact with dry packing, after one week's setting, was (while hard) more crumbly and friable than where the wet packing was used.

12. The question as to whether special tools are necessary for cement joints has been commented upon by all who have criticized the specification. One comment suggested that the design of tools offered would probably break in practice. This is simply a question of properly making the tools. Most of the other comments were to the effect that they had not found such tools necessary ; and exactly the same reply is made by the Committee as in the discussion of paragraph 8. The tools suggested will give a more uniform ring of packing than will the usual type of yarning irons. This was proved by actual experiment before the tools were adopted for the specification. One comment on the specification suggested that the Committee recommend that cement joints should not be used where the bead is cut off the spigot. In the absence of any specific data as to the strength of the bond between the iron and cement, and, further, there being no reported experience from practice that these joints would fail in use, the Committee do not feel justified in making such a recommendation. This is particularly true as they do not feel that they have at this time any substitute joint to offer.

13. The original specification called for Dykerhoff cement as a first preference. This brand is practically out of the market, and, further, it is questionable whether it is as good as when it was first used for cement joints about ten years ago. Further work of the Committee should include the preparation of a specification for cement for cement joints. It will be noted that the cement must be in perfect condition, which was thought to be sufficient qualification, rather than to go into details; but the screening is included. This was done purposely, as even when cement is apparently carefully stored, it will sometimes become in spots a little damp and lumpy. The specification, therefore, provides for screening, to insure its being free from such lumps. It is provided that it will all be used within fifteen minutes after mixing; and this was specified rather than saying, "Mix enough for some given number of joints," which is the usual formula. The weakness of this is obvious.

14. The fact that a trowel was satisfactory to fill joints was determined by experiments with the split bells; but, of course, there is no implication that the cement may not be satisfactorily placed in the joint with rubber gloves, as is the practice in a number of locations. The trowel was cheaper and more durable. The use of the rope for driving in the first filling of cement is also not a new idea, but is offered in this specification as an improvement over the current practice. Experiments show that the width of the cement band would be increased $\frac{1}{2}$ inch by the use of the rope and the refilling, over the usual practice of filling the joint once either with gloves or with the trowel. If a pusher were used, there was not so much gain by the use of the rope. This is, however, one of the points that the Committee believe will go further to insure more uniform joint-making. If the practice as suggested is followed, there would apparently be no question of having the joint filled properly with cement, while the Committee do not believe this would always hold with the usual method of making the joints.

15. This paragraph is self-explanatory.

16. This pointing is done to seal the front yarn, and to make a sharp surface to test the joint. The operation can be done better with the trowel than with gloves. The section shown is an average of a number of joints made in the split bells by the methods described. There would seem to be no question that they are an improvement over the sections usually shown.

17. This paragraph was added as the Committee believe the efficiency of the operation will be increased if an approximately uniform temperature is maintained from the time the joint-making starts until the pipe is finally covered.

18. This paragraph is included because the majority of engineers believe that joints should be tested. As a matter of fact, a very respectable minority do not test their joints in small mains when laid for ordinary gas pressures.

19. This and the following paragraph do not imply that the Committee specifically recommend the use of cement joints for large mains. It is believed, however, that there is sufficient evidence to indicate that they can be satisfactorily made in deeper bells; and this and the following paragraphs are, therefore, included. Three reports on the use of deeper bells for cement joints for large mains have been received. One was used in combination with lead joints—*i.e.*, several cement joints followed by one lead ; and the report was that the cement joints were entirely satisfactory. The second part was on a continuous line of cement joints. The report here was promising but not entirely favourable. The third was from a situation where cement joints in standard bells had been used in all sizes of large mains up to 24-inch with numerous failures. The experimental line had at the time of the report been in use for two years with no sign of failure. This was a line of main with depth of bell as given in

this specification and cement joints made up according to the directions.

20. It is not good practice to attempt to space large joints with the yarn when the minimum quantity of yarn is to be used as in cement joints. Therefore, the larger and heavier pipes are spaced with wooden wedges on wooden blocks.

21. This is added as an additional precaution to insure the complete filling of the joint with cement.

22. This is to care for the wider angular ring in the larger joints.

23. This is added as an additional precaution in caring for temperature changes.

Before leaving the subject of cement joints, one important advantage should be touched on, and that is a line of main laid with cement joints is practically a non-conductor. Data collected from electrolytic surveys indicate a large immunity in gas-pipe systems laid with cement joints.

The further work of any Committee on this subject should include experimental work to determine an efficient and reliable large joint. There has been a great deal of experimental work done, with some interesting results which are not as yet conclusive. Through the courtesy of the United Gas Improvement Company, a summary of the data of a series of tests made by Mr. O. B. Evans is given herewith.

The joints were made with 20-inch special bells and tested in a testing machine of 500,000 lbs. capacity at the University of Pennsylvania, and were subjected to alternate compression and tension. The tests were based on the fact that a 20-inch cast-iron main underground subjected to a temperature change of 30° would be stressed 125,000 lbs. and would be subjected to alternate compression and tension due to the seasonable changes. In these tests the joints were made up as carefully as possible; the bells being of the standard "A. G. I." depth. During the alternate compression and tension stresses placed on the joint, air pressure of from 2½ to 4 lbs. was kept on the joints; and they were tested for leaks by using a trough made of putty around the joint and the trough filled with water. This was a more positive method of testing than with soap suds.

The cement joint, which was made in the usual way, and not according to the Committee's specification (as this work was undertaken before the final specification was prepared), failed under a tension strength of 40,000 lbs.—approximately one-third the safe load. The cast-iron joint made with the standard method with yarn and cast lead properly caulked failed after six reversals at about 25,000 lbs. Lead-wool joints with 1 inch, 1¼ inches, and 1¾ inches of lead wool caulked with a pneumatic hammer in the usual way remained tight for fifty reversals with a maximum of 80,000 lbs. tension and compression with a movement greater than would be experienced by the main underground.

The combination cement and lead-wool joint, consisting of back yarn, a band of cement which was allowed to set, and then lead wool caulked in front proved about the same efficiency as the lead wool and yarn alone.

These experiments were continued with cement, cast lead, lead wool, and combination lead wool and cement, with the results that the lead wool or combination cement and lead wool, caulked with a pneumatic hammer, was shown to be the most satisfactory under laboratory conditions.

At this time the Committee feel justified in suggesting that in mains 10 inches and over a joint made of a combination of cement and lead wool will probably prove satisfactory. An inch of lead wool gives as high an efficiency as the wider bands in making up these joints. After filling the joint with cement to a point 1¼ inches from the face of the bell, the space should be carefully cleaned; and after the cement has set not less than 24 hours, the lead wool should be caulked-in with a pneumatic hammer or with hand caulking tools and 8-lb. striking hammers.

The further work of the Pipe Joint Committee should include the proposition of preparing a definite specification for the making of these combination joints. Unfortunately, the United Gas Improvement Company's experiments have not as yet taken up the cement joint in deep bells. It is hoped that this work can be done within the next year.

One further interesting experiment which Mr. Evans made was on a joint with impregnated yarn. This joint is made up on the theory of the stuffing-box as described earlier in the report. Under the test the joint failed under eighteen reversals at 40,000 lbs. pressure with an elongation of 0·2 inch. This method of testing was not conclusive, however, because 0·2 inch is a much greater amount than a joint would move with the underground range of temperature. The Committee believe that the only laboratory test that would give any indication of the value of this joint would be to subject the joint to continuous reversals through a range slightly in excess of that which would be expected in underground work.

In line with the so-called stuffing-box joint, and on the theory that the packing plays a most important part in any type of so-called flexible joint as distinguished from the rigid joint, Mr. Evans made a very interesting experiment. He found that, with two joints made up as nearly as possible identical, the one with the yarn driven the harder showed the lesser tendency to leak. If this could be shown by laboratory experiment to hold in practice, it would make a most interesting advance in the practice of joint making. The idea is, the Committee consider, worthy of much further experiment.

DISTILLATION OF TAR ON GAS-WORKS.

[From a Correspondent.]

In the December issue of "Het Gas," Heer A. P. Bruigo publishes some reflections concerning the treatment of tar i gas-works plant.

The author points out that all sorts of gas-works residuals ar treated in gas-works plant, sometimes in fairly intricate installations, and that many of these treated residuals represent marketable products which are easily sold, and yield in most cases a goo profit. Tar in this connection occupies an exceptional positio as there are only a small number of gas-works where it is distilled. He inquires as to the cause of this. The treatment o ammoniacal liquor for the production of sulphate of ammonia an the extraction of cyanogen and sulphur products from the crud gas or from spent oxide has never been a philanthropic matte nor is it so with the distillation of tar in chemical works. Ta has not followed the general progress in technical operation Everywhere else one meets with modernization of appliances an of the plants in use; but in the matter of tar, time had gone o and left the stills in the same primitive state as they were whe chemists started the distillation of it. In many cases, tar is distilled in the same manner as it was fifty years ago, in stills of shee iron—the capacity varying between 5 and 30 metric tons. Th residue left in the stills is the pitch; and before the still can b filled again, this must be removed. There is thus no questio about a continuous operation.

The principal improvement of recent years is confined to th substitution of indirect heating by means of hot water or stea for direct heating. But with these modes of heating it has prove very difficult to obtain the necessary temperatures; so that the followed the use of a vacuum, so as to reduce the boiling-points o the components. In this manner, the working of the plant became less economical; and so the processes are to be regarde as things which have led the tar chemists astray. The laws o physical chemistry tell us that in the tar distillation process all th components are volatilized simultaneously, but in such a manne that of the components with lower boiling-point there is a large quantity present than of the higher boiling-point constituents. Thu the condensed distillates are far from homogeneous, but contai on the contrary, both higher and lower boiling products. Continuous boiling for a long time of a voluminous mass requires considerable amount of heat; and as the viscous liquor has tendency to boil over, and tar possesses great inflammability a these temperatures, the fire danger is real. Furthermore, th stills have only a short life. These are features of old-time ta distillation; and it is somewhat peculiar that only recently hav methods been devised for the treatment of tar in a differe manner. Among these modern methods, the Kubierschky continuous process may be mentioned; but, of course, there ar others that would be suitable.

Kubierschky does away with all the old plant, with its fire danger and high cost of wear and tear, and uses a column apparatus, similar in appearance to an ammonia still used for sulphat making. The crude tar is pre-heated, and flows continuously i a thin jet into the apparatus, where it passes downwards alon coke or other suitable filling material, while a jet of superheate steam is introduced in an upward direction. The presence o steam of a relatively low temperature with regard to the boilin temperatures of the heavy oils, causes the vaporization of th lighter oils as well as of the heavy oils; but the composition of th vapours is governed by the law regulating the vapour pressure o heterogeneous liquids at a given temperature. When distilling a 100° C., and under atmospheric pressure, oils that have a boiling point of 200°, 300°, and 400° C., the quantities of steam needed fo the distillation of equal quantities of these oils are in the proportions of 1 : 8 : 60; but working with superheated steam of 200° C these proportions become 1 : 1·6 : 2·4. Better than words, thes figures demonstrate the highly favourable influence of the use o superheated steam.

The distillation is carried out by degrees, and in such a manne that the vapours are immediately separated from the remainin liquor. In the bottom part of the apparatus, no vapours of lo boiling-point are present; so that the hot liquor leaving th column is nothing more than molten pitch, which becomes perfectly solid after cooling. Of course, the distillation may be s conducted that soft pitch is obtained, and the separation of th fractions is sufficient for gas-works purposes. The consumptio of steam is about 30 lbs. per 100 lbs. of tar; being equivalent t about 4 lbs. of coal. The starting of the plant may follow directl after the apparatus has been pre-heated. The tar inlet and stea inlet are regulated by valves, so that from this point of view n special cost is incurred. Insurance and depreciation are reduce with this dangerless system. The only auxiliary plant needed fo the working of it is a steam-generating plant; and this is to b found on gas-works of any size.

The author gives some figures regarding a plant for a gasworks producing 1500 metric tons of crude tar per annum, an where therefore the gas production in the same period woul amount to about 350 million cubic feet. For this plant, a buildin 13 ft. by 17 ft., and 20 or 23 ft. high is necessary. The 1500 to of crude tar will give 600 tons of tar oil and 900 tons of hard pitc Taking the selling price of crude tar at 35s. per metric ton, an that of pitch at 45s., the return for the tar oil produced is calc ed at 30s. 5d. per metric ton. This figure is arrived at in the lowing manner:—

Installation cost (stills, pipes, tank, pumps, building, and fitting up)	£750	0	0
Working cost (interest 5 per cent., depreciation 10 per cent., repairs 2 per cent.)	217	10	0
Tar, 1500 tons at £1 15s.	2625	0	0
Steam	45	0	0
Fuel oil	52	10	0
Wages	50	0	0
Water and light	10	0	0
Insurance and unaccounted-for costs	30	0	0
	£2940	0	0
Revenue from 900 tons of pitch at 45s.	2025	0	0
Cost price of 600 tons of tar oil	£915	0	0

Taking the selling price of tar oil at £2 12s. 2d. per ton—a low ce—the net profit of the undertaking is reckoned at about £650, ich is a good figure, in view of the capital cost of the plant.

The author also gives some figures supposing that the tar oil is t sold in the market, but is used on the works for the carburet- g of water gas. In this case, we will not follow the author in calculations; for we all know, from practical data, that tar oil not a carburetting material which gives very tempting results carburetted water-gas apparatus. It is certainly of interest at the gas industry have at their disposal new working methods dealing with a residual of high intrinsic value. In many in- nces, the market value of this residual has been governed by veral outside factors—such as freight and storage; but the new stem will change this, and enable gas-works to derive the full ofits of the residuals they produce.

EFFECTS OF ELECTROLYSIS ON PIPES.

Gas and Water Tracks and Electrical Drainage.

Dealing with the effects of electrolysis on engineering structures, e case of underground piping was naturally considered at some gth by Mr. A. F. Ganz (Professor of Electrical Engineering at e Stevens Institute of Technology), in an address which he livered before the last International Engineering Congress, held San Francisco.

Referring specially to gas-pipes, he said it is sometimes found at underground pipes and other metallic structures of a gas- orks receive stray currents from the various pipes which con- ct the works to outside piping systems. Since stray currents e particularly objectionable here, on account of electrolysis and so possible danger from electric sparks, the entrance of such rrents has, in some cases, been prevented by installing insu- ting joints in each of the pipes connecting to the works. In e gas-works, which is located on a salt-water inlet opposite the ilway power station, large stray currents were found flowing rough, and endangering, not only the piping of the works, but so the bottoms of tanks. At the railway power station, the gative bus-bar was connected by bare underground cables to acks directly in front of the station; and this caused to concen- ate towards the power station stray currents, some of which, in eir path, flowed through the gas-works. In the case of two oil- nks, stray currents of considerable magnitude were found to w to them from the connecting oil-pipes, and thence to earth. protect the tanks, insulating joints were installed in the pipes, ereby preventing the entrance of current. The stray currents rough the works were later sufficiently eliminated by discon- cting the bus-bar at the power station from the tracks and from ground contacts, and installing insulated return feeders to ints in the tracks surrounding the gas-works, which feeders ere proportioned for equal voltage drops. In this way, a sub- antially equipotential zone was set up around the works; and e former tendency for current to flow through them was in this ay removed.

While in a number of American cities electrical drainage has, oceeded Professor Ganz, been applied to both the gas and ater piping systems as a protection against electrolysis, no com- ete tests of an extensive electrical drainage system applied to pes are available, so far as he is aware. Such tests as have been iblished consist only of current measurements on the pipes and potential measurements between the drained pipes and trolley acks. The complete data from which to judge the effectiveness the system would involve the results of many other tests, par- cularly of measurements of drop-across joints in the pipes, and measurements of potential difference between the drained pipes d other underground structures.

Electrical drainage was first applied to lead cable sheaths; and e success in protecting cable sheaths in this manner led to the tempts to apply the drainage method also to pipes. There are arked differences, however, between an underground piping sys- em and a lead cable system, which render the piping system much ss suited for electrical drainage. The principal difference is that able sheaths are continuous electrical conductors; while pipes ay be more or less discontinuous—due to the presence of high- sistance joints. Another difference is that the lead cable sheaths re relatively small, and are carried in ducts, which are mostly on-metallic. Thus only part of the surface of the cables is in contact with earth; whereas underground pipes are buried directly in earth, and generally present enormous contact areas to earth. The consequence is that when electrical drainage is applied to pipes, the currents on the pipes are very greatly increased. This results in danger of current shunting around high-resistance joints or leaving the pipe on the positive side of a joint to flow to other structures.

If the pipe which is electrically drained is one which conveys an inflammable liquid or gas, or if it passes through a manhole or other confined space where inflammable gases may collect, the flow of stray current on the pipe may involve the danger of an explosion or fire, particularly at times when the continuity of the pipe is interrupted for repairs or from other causes. Many cases have been reported where, in interrupting or rejoining or re-caulking mains, electric arcing was produced. Professor Ganz has found that in a number of cities where pipe drainage is employed it is the general practice, when mains are to be interrupted or a joint is to be re-caulked, to first connect a heavy copper wire across the proposed break, so as to prevent danger from arcing. He has also come across one case where a high-pressure gas-main pulled apart at a joint in an open ditch, and the arc caused by the interruption of the main ignited the gas, and made it necessary to shut off the gas from the main, and therefore the gas supply for an entire town, in order to extinguish the flames and repair the break. In this case, the gas-main was electrically drained to the power station, and carried a large current.

Where both gas and water service-pipes enter buildings, the result on the pipes of producing large stray currents is generally also to produce a flow of these stray currents through buildings; the current flowing in on one service-pipe, passing to the other service-pipe through metallic contacts in the building, and then flowing out on the other service-pipe. Such stray currents through buildings constitute a serious fire risk. The Professor has seen cases where severe arcing was produced between water and gas service-pipes in buildings whenever there was a vibration of the pipes. The complete application of electrical drainage to pipes will, he declares, involve draining all underground piping systems—and, in fact, bonding together all underground metallic structures affected by the stray currents—in such a way that at every point where different structures come into proximity in earth, they are brought to practically the same potential. If this is not done, there will be at such points a flow of current through the earth from the structure of higher potential to that of lower potential, thus causing corrosion of the former.

When electrical drainage is applied to a single system of underground pipes, without making a complete investigation of the effects of possible high resistance joints, &c., the installation may be made at relatively small cost; and, when so applied, it usually relieves the acute danger from electrolysis in the immediate neighbourhood of where the drainage connections are made. Both of these considerations have served to favour the electrical drainage system. However, a single drained underground piping system becomes a source of serious danger to other systems. If electrical drainage is applied comprehensively to all underground metallic systems, it will not only be found very expensive to instal, but likewise expensive to maintain, because as railway and piping systems are changed, the drainage system must be changed accordingly. The large increase in current on underground structures produced by electrically draining them, also brings about dangerous conditions at scattered and unknown places, which is a serious objection to this method. As an example, in Pittsburgh, where electrical drainage is extensively applied to the water and gas pipes, it is reported that by way of the drainage cables which connect to these pipes from the main railway supply station, the current drained from the pipes is nearly one-half of the total station current.

Concluding this portion of his address, Professor Ganz points out that in future installations of underground piping systems in the neighbourhood of electric railways, precautions should be taken to minimize the flow of stray current to the pipes. To this end, the pipes should be laid as far from the electric railway tracks as practicable. Metallic contacts with the tracks must be carefully avoided. Where the pipes cross steel bridges carrying electric railway tracks in metallic contact with the bridge structure, the pipes should be supported on wooden blocks or be otherwise insulated from the metal of the bridge. Insulating joints should be installed at the entrance of pipes to all car sheds, as it is frequently found that the pipes inside the sheds are in metallic contact with the tracks through the building structure. In special cases of individual pipe-lines, insulating joints, and, in some instances, also insulating covering of adequate thickness, may be employed in localized sections, where conditions are found to be suited to their installation.

Coke as Railway Fuel.—The scarcity of coal, which has prevailed in diverse quarters during the war, has caused more attention to be paid to other fuel—in the first instance coke. According to "Engineering," in Sweden coke has, to a considerable extent, been used for locomotive fuel mixed with coal; but recent experiences have shown that coke is better suited for this purpose during the summer than the winter—the reason being attributed to coke absorbing more moisture from the atmosphere in damp weather than is calculated. As a result, trains have frequently been late; and the State Railway Department recently ordered that only coal should be used during Christmas time, which always brings about much increased traffic.

DEFINING "DOMESTIC PURPOSES" IN WATER SUPPLY ACTS.

In the issue of the "JOURNAL" for Dec. 21 (pp. 645-647) there was given the text of the paper on the above subject read at a meeting of the Institution of Water Engineers by Messrs. A. B. E. BLACKBURN and PERCY GRIFFITH. It led to the following

DISCUSSION.

The PRESIDENT (Mr. F. W. M'Cullough, of Belfast) said they were much indebted to Mr. Blackburn and Mr. Griffith for their interesting paper on the important subject of the definition of the term "Domestic Purposes." He moved a vote of thanks to the authors.

Mr. H. ASHTON HILL (South Staffordshire Water-Works Company) seconded the motion, which was heartily carried.

Mr. ASHTON HILL, opening the discussion, said the authors asked "whether it was not time to reconsider the whole question of domestic charges on its merits, and devise some method, firstly, of limiting the application of the term "domestic purposes," and, secondly, of adjusting (if necessary) the rates of charge as between "domestic" and "non-domestic" uses. How were they to do this? Later on in the paper, it was suggested that it might be done by each undertaking putting in the next Bill it promoted in Parliament a provision as to what was wanted, or an amendment of the Model Clause might be made. It appeared to him that the direction in which they had to work was to consider first what was to be done. Then the authors said that the further questions of what quantity of water and what specific uses of water were to be regarded as essential to health, should be carefully considered and settled by sanitarians, just as, in the matter of defining the term "pure and wholesome water," a standard should be fixed by chemists and bacteriologists. The water engineer would then know what was required of him, and be able to definitely calculate his liabilities both in regard to quantity and quality. They well knew what difficulty the Sewage Commission had had in their various reports in trying to found a standard for sewage; and he thought they would have greater difficulty in finding and adopting a standard for water. As to the liability regarding quantity, when they began to talk about quantity, it meant meters. The disadvantage of metering domestic supplies universally in this country had been generally admitted; and it had been recognized that it was cheaper to waste some water than to go to the expense of universal metering. The authors also said the individual consumer must be made to pay his fair share. But he (Mr. Ashton Hill) thought the individual consumer did so at present. He looked upon the matter of paying for water as being more or less a tax. The poor man got a great deal of water for little pay; and the rich man probably did not get any more, but paid a good deal more. He did not think they, as water engineers, wanted to disturb this happy arrangement. Regarding supplies for trade purposes in factories and workshops, he had just been considering a case which was perhaps an illustration of what was spoken of by the authors. In the works in question, they had two supplies, which were now metered, but were not formerly, as it was held that the supplies were for domestic purposes—for drinking by the workmen. The water for manufacturing purposes was obtained from the canal. Now they had an application for the laying of a fire-main into the works; and a second application was for taking a service-pipe from the end of the fire-main for another drinking supply. The owners of the works questioned the Company's right to make the demands they were now doing. It was seldom the Company had anyone tackling them in this way. The Solicitor to the owners of the works saw him on the subject; and he (Mr. Ashton Hill) simply told him that what was wanted could not be done. He was tackled on the subject of the fire-main. There was the question of its maintenance in the roadway; and he got the works owners to take upon themselves the responsibilities in regard not only to maintenance, but to repairs. He pointed out that they could not open the ground in the roadway, while the Company could; and so he said: "We will do it at your cost." Then they wanted the service-pipe at the end of the main without a meter; and he settled the matter by telling them it was not possible. He thought that water authorities should set their faces against having metered and unmetered supplies on the same premises, because there were some people who, intentionally or unintentionally, would forget the different purposes, and would go to the unmetered supply largely in preference to the metered supply. Then the authors spoke about the needless multiplicity of lavatories and other sanitary conveniences. He did not know what they meant there, because it was only possible to use one lavatory or convenience at a time. There were different principles applied to the charging for water. One was to get as much revenue as one could, and give as little as possible for it; another way was to estimate fairly the probable quantity of water that would be used, and then, according to the scale of charges, give the quantity of water, and anything registered by the meter over and above must be paid for in addition. There was another system of charging with which he was familiar, but which he did not think obtained very generally. It was this: Suppose a dwelling-house with attached to it premises used for trade. The house was rated (say) at £100 a year, and, if the town was not an expensive one for water, 3 per cent. might be paid as the water-rate for the house. Then there were the uses in the factory, which might amount to £10 a quarter, or £40 a year. What they did was to first make sure of the income for domestic supply on the rateable value to which they were entitled; then, adding a sum for the trade purposes, they said: "We will allow you so much water for that sum, which is a minimum." His Company did not find the slightest difficulty in making such an arrangement. The authors suggested that any alteration in the law should certainly have in view not only the interests of the water authorities and their officials, but also those of the public, who suffered quite as much from the present condition of affairs. He (Mr. Ashton Hill) did not know that he was suffering from anything in particular in this regard; and he did not hope to. Referring to non-domestic water supplies that were beneficial to the community, the authors cited supplies to trades which might be attracted to a particular area because the charges for water were low. But there might be other reasons than low charges; for instance, the water in the area might be good for ale, as at Burton. The authors seemed very anxious on behalf of the consumers, and urged that charges for similar purposes should be uniform in any district, so as to avoid preferential treatment. There were some undertakings—particularly small ones—which could only live by supplying both gas and water, and which probably had one very large consumer, and as a matter of policy they had to have differential prices. It was also proposed in the paper that special charges should be scheduled to Private Acts, so that there could be no doubt as to the charges being authorized by Statute; and then, when it was desired to alter the charges or add new items to the list, it seemed to the authors that alterations might be made from time to time merely with the approval of the Local Government Board, without going to the expense of promoting a Private Bill. He did not believe that the Local Government Board would welcome this extra duty. The filling of gasholder and petroleum tanks was something out of the ordinary; and, under the proposal as to special charges, until they had been to the Local Government Board, and got such tanks added to the list, they would be making an illegal charge for filling such tanks.

Mr. C. B. NEWTON (Hull) said he was sure all the members agreed that the paper was a very clear statement of the position which had disturbed the minds of those engaged in the business of water supply. The trouble experienced by the Metropolitan Water Board appeared to him to centre in the fact that too little regard was paid to the variations in the "intensity" of water consumption between one class of property and another. The Act of 1907 imposed a flat-rate of 5 per cent. for domestic supply; and the only variation allowed was a rebate of 20 per cent. in cases where the premises were assessed in a sum exceeding £300 per annum; and then only when the premises were not charged with inhabited house duty. The charge for domestic use of water was 5 per cent. on a house in the suburbs rated at £50, and 5 per cent. on a suite of offices in the City rated at £1250. In the first case, the rate produced 50s. per annum; and in the second case, after allowing for the rebate, it amounted to £50 per annum. It was quite conceivable that the actual consumption of water might be identical in each case. There was clearly something wrong in this scheme of charges. The water undertaking must be provided with an income sufficient to meet all liabilities; but the burden should be more fairly distributed. Further, he thought that modern sanitary requirements and the improved conditions under which they now lived had entirely disposed of the old 5 per cent. water-rate on dwelling-houses. In these days a rate of 7 per cent. appeared quite reasonable; and many large undertakings had imposed 10 per cent. To charge a rate suitable for dwelling houses on the heavy assessments carried by lock-up premises in business thoroughfares was an imposition; and, as it was out of proportion to the quantity of water used, or the service rendered, it was wrong whichever way one took it. Most large cities and towns in the provinces did these things much better. It was the fashion just now to standardize everything. But were they sure that, if it were possible to standardize a definition of a "domestic use" of water, this in itself would remove all difficulties? Probably their troubles would only begin when this was done; and, judging from the paper on which their friends had bestowed so much labour, he rather thought their own phrase "a vista of further litigation" summed up the future prospects. He would submit that a key to the solution of this problem was to be found in section 12 of the Water-Works Clauses Act, 1863. Here they had certain uses of water—for cattle, for horses, for washing carriages, for trade, for watering gardens, and for other purposes—expressly excluded from domestic uses. Surely, it would be comparatively simple for each water authority to settle for its area the particular uses which should be regarded as suitable for exclusion, and specify each and every one in its Private Act. This should establish a negative definition as a harbour of refuge from these troublesome matters. As a practical method of dealing with the rather difficult case of the combined domestic and business supply, he advocated a more general application of the principle of affording such supplies by measure, but insisting, as referred to by Mr. Ashton Hill, on a minimum charge corresponding to the domestic rate. The excess consumption beyond the value of the domestic charge would then very probably come into the account as an extra. This, in his opinion, was a simple and safe method of dealing with the difficulty.

Mr. E. ANTONY LEES (Birmingham) said, in discussing this paper, the members must keep in view what the authors had in mind, which was the searching out for some basis for a new arrangement which might be equitable from the points of view of the water undertaking, the consumer, and the public, rather than merely summing-up the position in which they found themselves in consequence of recent legal decisions. Exception seemed to be taken to the system followed in the Metropolitan Water Board Act of charging a uniform rate. Personally, he did not acknowledge the complete inequity of it. He thought that a uniform flat-rate, with proper allowances, was a right way to proceed. The respect in which he thought the Water Act fell short was that the allowances that were made in special circumstances were not altogether proper. Mr. Newton spoke of a house rented at such and such a sum in the suburbs, and another premises rented at a higher figure in the City—the one having to pay twelve or twenty times as much as the other. Mr. Newton seemed to think that this was in itself necessarily an inequity. If it was an inequity, they had many instances of it. There was rateable value fixed according to the position and importance of the premises. The people cost the authorities—for instance, for street cleansing—more than the house in the suburbs, although it might occupy more frontage. But it was felt that, in the interests of the public as a whole, there should be a uniform rate for street cleansing. Then, again, the premises in the City received protection against fire, and the risk was very much greater there than in the suburbs. But there was a saving on fire insurance by reason of the provision for water supply. These seemed to him to be reasons why highly-rated premises in the middle of the City should pay for their water supply—not merely for the water consumed, but for the provision of the public supply—at a flat-rate similar to that in less expensive areas. At the same time, he did recognize that there was a proper differentiation not on the ground of difference of rateable value, but difference of user. Here was a block of offices in a City which was only partially occupied. The ordinary residence was occupied the whole time; meals were cooked, and morning uses—ablutions, &c.—took place there. In the City it was only an occasional need during the day that called for the consumption of water. It seemed to be reasonable, then, that the question of partial user should come in, and should go to provide for a reduction in what one might term the flat-rate. Then came in another consideration—that the supplier of water wanted to be protected in respect that the partial occupation should not only theoretically but should actually entail a partial consumption of water. In Birmingham, they had recently secured a revised scale of charges. They obtained it after the decisions in the Avery and Oddenino cases; and they proceeded by intelligent anticipation by the method suggested by the authors of the paper. Their old Act prescribed a definite scale of charges for domestic uses—that was to say, compulsory uses. Instead of going for a new Act, they obtained a Local Government Order, whereby the Board were clothed with power to sanction scales of charges for water in Birmingham—such scales of charges to be submitted to them from time to time. Having obtained the Order giving the Board this authority, the Water Department then introduced their scale, and had obtained it. The rates were high, for reasons he need not discuss, but with which many members of the Association were more or less familiar. The point, however, to which he wanted to call attention was this: In respect of the city hotels, public houses, restaurants, and clubs, they had introduced what seemed to him, so far as he knew, a new principle, and which he ventured to think contained the germs of a possible way out of many of their difficulties. They all were aware certain uses of water in connection with public houses, for which many of them had been accustomed to make special charges, were declared in the Avery case to be included in the domestic rate, and had therefore to be withdrawn. The value of the licence was included in the rateable value; and a publican might reasonably say he was paying for uses incidental to his trade by such increase of the rateable value. The method they had adopted was this, to offer to allow the consumer in the hotel having the right to demand it, a rebate of 25 per cent. off the full domestic rate, and this, *plus* the charges for baths, or according to the size of the meter, whichever was greater, divided by four, provided the domestic minimum. This was only applicable where premises exceeded £80 a year rateable value. By this method, they made it worth while for a customer to economize in the use of water; the Water Department being protected by the presence of the meter, and the provision that the supply should be charged for according to the meter scale in operation for the time being. They applied the same principle to factories by having a modified domestic rate going down as low as 3 per cent., and then putting in a meter, giving for the domestic rate divided by four a certain quantity of water, as allowed in the meter scale. They had had a revaluation made in cases in which the full machinery was included in the rateable value; and in consequence of this, it had been necessary in cases of *bonâ fide* factories to make still further concessions; otherwise the charges would have been unreasonably excessive. This was the application, not merely by agreement, but by the sanction of the Local Government Board, of the principle to which Mr. Ashton Hill and Mr. Newton referred.

Mr. C. H. **Priestley** (Cardiff) said it seemed to him Mr. Lees had, in the first place, tried to make out that the flat-rate was not inequitable, and then afterwards that it was so to a certain extent. To him (Mr. Priestley) the flat-rate did seem to be inequitable, for the reasons pointed out by Mr. Newton. But he thought it might have been got over in another way to that suggested by Mr. Lees—in fact, he believed it had been got over in Manchester for a great number of years. He understood that there a penny rate was charged for all purposes of water supply in addition to that for domestic uses. The penny, of course, could be any other amount. It seemed to him that the domestic rate in the first instance should be assessed on a reasonable basis; and if this was not sufficient, then, instead of putting an undue charge upon certain consumers, as the Metropolitan Water Board had done in the City, it might be made a flat-rate in this sense, that the rate was applicable to all premises and in the nature of a rate-in-aid. In connection with the standard rate of charges mentioned by the authors, it seemed to him that no given quantity of water per head was reasonable and proper for every place. They knew quite well that in such places as Brighton, Cheltenham, and many other watering-places, the use of water was considerably more per head of the population than in such places as Sheffield and Manchester. It therefore appeared to him that no equitable basis could be arranged for supplying a given quantity of water per head of the population. His Committee and himself had never found any of the difficulties which seemed to be so prevalent among some other members of the Institution. The Acts of Parliament in their case defined the domestic supply, and the rate to be paid for it; 5 per cent. under £20 rateable value, and 4 per cent. for £20 rateable value and above. Personally, he did not think they could take too liberal a view of the employment of water for domestic purposes, because he believed it was for the benefit of the health of the people that they should use, though not abuse the use of, water as much as possible. The authors pointed out that it could not be denied that modern ideas of sanitation involved a larger consumption of water for domestic purposes than did the ideas existing in the year 1847; and this extra supply had generally been afforded without demur by water authorities. It should be borne in mind, too, that these water authorities had had to lay out more money than was expended by water authorities in 1847. He agreed that some definition should be made as to the question of pure and wholesome water; but he did not think any general definition was applicable to every district in the country. The authors mentioned that, in manufacturing areas, a considerable proportion of the water supply was for trade purposes in factories and workshops; but they might have added many other uses. In his own case, the bulk of the supply was for dock purposes. The trade purposes in Cardiff represented over 12½ gallons per head as against a total consumption of 28 and 29 gallons per head—the rest being for domestic purposes. As to an extra charge for a garden, he believed the garden was incorporated in the assessment of the premises; and he did not think it right there should be anything extra charged for a garden. The authors suggested that to the Legislature, guided by the sanitarian, should be left the prescribing of the dividing-line between domestic and non-domestic purposes. If the "sanitarian" was the medical officer of health, then he thought the water-works engineer was quite as capable of guiding the Legislature.

Mr. F. J. **Dixon** (Ashton-under-Lyne) hoped the result of the paper and discussion might be the drafting of a small General Bill which could be utilized in future legislation. The whole question of what was domestic supply, was a legal one; but the decisions given by eminent Judges were apt to create confusion. In the Avery case, Lord Justice Buckley asked, "What is the test for domestic supply?" Another said: "The test is the purposes for which the water is being used, and not the character of the premises in which the water is used." Twelve months after, in the Oddenino case, Mr. Justice Sargant said: "The test is the character of the house to which the water is being supplied, and not the purposes to which the water is actually being put." Following these two decisions, he (Mr. Dixon) felt himself in great difficulty. He was going to take the part of the consumer that day, because he felt that a good many private companies were trying to screw the last drop of blood out of the consumer. He believed that an innumerable list of supplies which should not be included as domestic had been irritating to the consumer. Take a house for which the tenant paid £100 a year—a house surrounded by a garden, and with a stable attached, or motor-car house and a cow-shed. The valuer who made the gross assessment would naturally take into consideration everything in arriving at the valuation for rating purposes. Whether a flat-rate or a differential rate was charged for the house, he (Mr. Dixon) contended that there should be no charge for water-closets, washing of carriages, and keeping the cow-shed clean. He had drawn up a clause which he thought applied to his contention. He would have the definition of domestic supply read as follows: "A supply of water for domestic purposes shall include a supply of water to a private dwelling-house when the water is used for washing, drinking, cooking, and sanitary purposes, also a supply of water for baths, water-closets, horses, cows, and for washing carriages or motor-cars, where such are kept for the sole use of the occupier." As to non-domestic supply, his definition was: "A supply of water for non-domestic purposes shall include a supply of water other than for domestic purposes." He did not think they could have a simpler definition for non-domestic supply, as it covered all that was not in domestic supply. Non-domestic supplies, in his opinion, should be measured by meter; and he believed if this were done, there would be no difficulty whatever. It would be more equitable to the consumer.

Mr. **William Whitaker**, F.R.S., F.G.S., congratulated the authors upon their boldness in tackling the subject of definition, because, in his experience, the moment one began to define anything, one was landed in almost inextricable confusion. They had, for instance, heard how the Judges of the land differed in defining the word "domestic."

Mr. A. W. Oke thought the use of the paper would be to point engineers to the need of codifying the Acts referring to water supply.

Mr. C. Clemesha Smith (Wakefield) asked whether it was really desirable that they should have the term "domestic" more clearly defined; and, if it ought to be, how were they to attain their end. The authors had endeavoured to put before them several positive difficulties. They had heard others during the discussion; and Mr. Whitaker had shown them how hopeless it was to define almost anything in the world. They were therefore driven to the negative definition, which, as Mr. Antony Lees indicated, worked very well in Birmingham. It seemed to him that the only method left to them was to exclude specific purposes from domestic use.

Mr. F. L. Ball (Mid Kent Water Company) looked at the matter as one responsible for the water supply of rural areas. His Company were strongly pressed to be put under compulsion to supply water to farmers. The argument was that farmers were milk sellers; and they were bound to provide a proper supply of drinking water for the cows, and for the washing of vessels. The Rural District Councils said, as farmers were under this obligation, they ought to be in the position to ask for a supply of water; the Company giving the supply on such terms as they thought fit. The point was met by the Company offering a clause providing for such agricultural purposes; but they guarded themselves to the extent that, in the event of a shortage of water, they should be relieved of the obligation to supply the farmers. It was also provided by the clause that the farmers must pay the expense of extending the mains; while the Company were to keep them supplied at a minimum of £4 for three years. It seemed to him there must be compulsion of supply where, in a water company's or authority's district, Parliament put upon anyone the obligation to provide himself with a proper supply. The speaker next referred to the question of the supplying of premises—say, with a meeting-hall attached. In this connection he read the following clause, which was commonly put into Acts of Parliament when the water-rate was chargeable on the rateable value of any premises entered in the valuation list: "When the water-rate is chargeable on the rateable value *of a part only of any premises entered in the valuation list for poor rate* (such part not being separately assessed to the rate for the relief of the poor), such rateable value shall be a fairly apportioned part of the rateable value of the whole premises ascertained as aforesaid; the apportionment in case of dispute to be determined by two justices." In one case where a meeting place was attached to the main premises (an inn), the consumer contended that the Company had no right to charge on the total of the rateable value, which included the meeting-hall. But the Company pointed out that the persons frequenting the meeting-hall used the lavatory accommodation at the inn, and so the Company were in fairness entitled to charge on the rateable value. They had not found much difficulty in insisting on non-domestic supplies being all metered. In regard to baths and extra water-closets, charges for them were irritating to the consumer.

The President said that in Belfast they had the advantage of defining in a negative way what were not domestic supplies; and they had no difficulty. Parliament had given them power in their several Acts to do this. In their last Act, they were granted power to define some of the more modern uses which they considered were not domestic. They also had rating above the 5 per cent. basis on the valuation, and could work up to 13 per cent. But in their domestic supply they included, free of charge, all baths, water-closets, washing-basins, and things of this sort. Mr. Antony Lees had referred to the question of a flat-rate. They had a flat-rate in Belfast for premises other than domestic. For business premises which were not domestic, they had a rate of charge one-quarter of the domestic, whether or not water was consumed. This was a general charge, for the water-mains were carried past the premises, and they had the advantage of the supply for extinguishing fire.

Mr. Blackburn, replying to certain points in the discussion, said both Mr. Griffith and himself were pleased the paper had given rise to such a good discussion. The object of the paper was to provoke discussion, and to this extent it had succeeded. The idea at the back of their minds in reading the paper was that there should be some amendment of the Model Bill, or some settlement of this vexed question as to what was "domestic supply," and that the Institution should take its proper place in advising on any such amendment, because, owing to the seemingly contrary decisions given in the Law Courts, matters could not rest very long in their present position. "What is a domestic supply?" Did the test turn on the character of the user or on the character of the place of user, or did it turn on both? It was recognized by the authors that it was rather difficult to make very much progress; but it was hoped that there would be some suggestions in the discussion which would enable the Council, who had been considering this matter during the last two years, to take some practical steps. Now, regarding the remarks of the speakers. Mr. Ashton Hill seemed to think it was cheaper to waste a certain amount of water than to adopt meters. To some extent, this was true; but everybody wanted to stop-off objectionable waste. Many generations had grown up to the use of water supply without meters; and so people would strongly object to have water-meters, and to have to pay rent for them. There was the possibility that someone would one day invent a penny-in-the-slot water-meter, as in the case of gas-meters. Mr. Hill said he had no difficulties at all. If he was the sole arbitrator, he could not have a better; and a very great deal did depend upon the tact and the personality of the officials of the water authorities, in order to prevent irritation. Mr. Hill also mentioned the question of trading concerns in his district who got practically the whole of their trade supply from a canal, and only came to the Water Company for a drinking and fire supply. Where a large factory or works using water for trade purposes took a small supply for domestic uses, the question was raised as to making a separate domestic charge apart from the meter charge. One of the points they had to consider there was whether the domestic consumption was at a different time from the trade consumption. The domestic consumption might also be so small that a large trade meter would not register it. In this case the practice he thought—and it was a good one—was to have either a domestic charge separately, with distinct piping not passing through the trade meter, or a small meter for the separate purpose. What the authors were advocating was uniformity of principle for the whole country—not uniformity of charge. Uniformity of charge would have to depend upon the cost of obtaining the water. But they did advocate uniformity of charge in the area of each undertaking. Mr. Newton spoke about distributing the burden of the cost of the water. The water had to be paid for by somebody, and the great object was to distribute the burden of the cost fairly; and he thought that, on the whole, this had been done. Mr. Newton seemed to think that the solution of the problem was section 12 of the 1863 Act; and he advocated continuing the negative tests that they now had, and which had given rise to so much litigation. Mr. Antony Lees mentioned the question of fire insurance. He considered that, because the water authorities laid their mains past premises, there was a great saving on the fire insurance rate; and that this was one reason why water authorities should be allowed to charge for fire purposes. His (Mr. Blackburn's) own authority did charge for fire purposes when the hydrant or main was taken into private premises. Under the Act of 1847, however, they were not allowed to charge when the water was taken from hydrants or mains in public streets. In the case of their President, and in the case of Manchester, where a flat-rate was levied whether or not water was taken, this covered the cost of the charge for fire. Mr. Antony Lees' new principle in the Birmigham scale of charges was distinctly an interesting one, and entailed the charm of a principle which might be largely extended in the future. Mr. Priestley also made the point that in Cardiff they had no difficulties; nor had he (Mr. Blackburn) any, save such as could be overcome. Mr. Priestley finished up by saying that he advised using water as much as possible. It was a dangerous thing to say this, unless they coupled with it the qualification that there should be as little waste as possible. Waste was a thing on which they wanted to lay more emphasis. Mr. Dixon desired to know who was the sanitarian to whom the authors alluded. The authors did not like to suggest that water authorities were the proper people. They were sanitarians if nothing else; and he did not see how matters would get on without consulting the water authorities. Mr. Dixon also said that the provisions of most Private Acts were very irritating to the consumer; and he thought there ought to be no charges for washing carriages, cars, &c. This depended on whether the charge made was high enough to cover these things. If so, he (Mr. Blackburn) would have no objection to this at all. Mr. Whitaker said the authors were very bold, and at the same time very modest. Both Mr. Griffith and himself appreciated that this was a difficult subject to tackle; but they were not deterred by that. Mr. Oke suggested that the proper thing to do was to codify the laws on this question. This was really why the paper was read.

Mr. Percy Griffith, also replying, remarked, in regard to those members who said, because they had no trouble in this matter, they did not think it necessary to take any action, that this was not altogether a wise attitude. Some members of the Council had been looking ahead, and saw the possibility of difficulties which were not contemplated coming along unexpectedly; and they thought it better to foresee and prevent them. They also thought that, the matter being a complicated one, an effort should be made to simplify the general definition, so that the consumers might know what their position really was, and have some reason for accepting it without demur. As to the remarks of the speakers, those who knew Mr. Ashton Hill could well understand that his verdict was readily accepted. But they were not all quite so influential, nor so fortunate in that respect, as Mr. Hill; and he (Mr. Griffith) thought they might reasonably conclude that these difficulties were better dealt with in advance. He had been asked to speak as to the multiplicity of closets, conveniences, lavatories, &c. Each one was a possible—and he thought a constant—source of waste, in practice; and in this respect they should not be considered as involving no further use of water. The multiplicity of such conveniences did sometimes create a little more frequent use; and he thought they ought not to be multiplied indefinitely upon any given scale of domestic charge. He was interested to hear Mr. Antony Lees discuss and defend the flat-rate of the Metropolitan Water Board. This flat-rate had not had many defenders; and he thought Mr. Lees' eloquence was needed to give a qualified support to it. His remarks amounted to this, that, with such a flat-rate, there would be so many exceptions for special cases that a flat-rate was of very little advantage. At any rate, this was the impression he (Mr. Griffith) got from Mr. Lees' remarks. He was also glad to hear Mr. Lees refer to the Birmingham scale of charges. He (Mr. Griffith) ought to say that, in the consideration given to this subject over the last two years, the Council had had the scale before them, and had appreciated its novelties and its excellencies. But one was tempted to observe the fact that everyone who had a particular scale of charges which he had thought-out for himself regarded it as the most important thing that had ever been proposed, and considered it did not need improving. No doubt Mr. Lees was of opinion that he had something good. Nevertheless, the Council had agreed that a little general discussion of the principles underlying these charges would be very useful. This was the object of bringing forward the subject that day. As to the specific legal case applying to a laundry, the one they had in mind was that in which the Bognor Water Company were concerned, but this was a school laundry. They had not found a specific case for a trade laundry. The President informed him that in Belfast the workhouse laundries were charged by meter separately from the workhouse itself. He was glad to hear Mr. Ball give his experiences in rural areas. These illustrated the desirability of comparing notes under the varying conditions applying to the water undertakings throughout the country. Surely some Model Bill which would be generally applicable, and useful to the consumer as well as to the water engineer, might be framed to deal with this question. He was at liberty to say that the Council would be encouraged by the discussion that day, and would give further consideration to it on practical lines, with a view, if possible, of drafting something which might be worthy of being submitted, in the name of the Institution, to the Legislature.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Exports of Sulphate of Ammonia.

Sir,—With reference to our letter of the 23rd inst., we think it right to inform you that we received a letter from "The Times" on the 28th inst. saying that they fully intended to publish our first letter (copy of which we sent you), but substituted our second letter—published in the "Journal," p. 717—to give us an opportunity of stating our case more fully.

Sulphate of Ammonia Association.
D. Milne Watson, Chairman.

84, Horseferry Road, S.W.,
Dec. 30, 1915.

Gas in Train Accidents—Naphthalene Troubles.

Sir,—Two matters referred to in your issue of Dec. 28 are of special interest to me.

I cordially agree with your protest (p. 697) against the unqualified nonsense which is appearing in the public Press as to gas in train accidents. A railway collision is always a terrible matter, and more horrible than ever when fire occurs. But you cannot have white-hot ashes sprinkled over inflammable material without a fire—particularly when there is any wind. It is conceivable, under some extreme circumstances, that the gas lighting of carriages may have some bearing in the matter—indeed, it may be said to have been proved in one case as a contributory cause. But much of the evidence, including the first report of the Board of Trade Inspector on the subject, has been quite inconclusive; and those of us who have had actual experience, and know of the experiments that have been made on the very point of safety, realize how remote the risk must necessarily be. Surely it is obvious that, on violent impact, extinction of lights is almost certain; and, with the inevitable disruption of pipes and cylinders, all gas must be speedily lost. After all, the gas lighting of trains is no new thing. It is in vogue all over the world, with great advantage to the passengers, and has been for many years past. It is only recently, however, that the remarkable allegations have been made concerning the danger.

Now in regard to naphthalene troubles (p. 709), Mr. Carpenter, of Great Yarmouth, in giving his interesting experiences with reference to the "C" process, makes the following statement: "I cannot think, *although it has been stated*, that there is, under varying conditions of temperature, absolute freedom from naphthalene nuisance in the gas services." In view of this, it is permissible for me to refer to the carburation process, presumably forgotten by many, but in use in works at home and abroad. By this process, when applied on the outlet of the governors and regularly and efficiently used on the whole of the gas distributed, it is possible with a small amount of oil to keep the distribution canalization clear of naphthalene, and Mr. Carpenter can be perfectly assured of the fact. He would find here at Hastings, for instance, that naphthalene in the service pipes has been unknown for many years past; and what is possible here, is possible under similar circumstances of application elsewhere.

Chas. F. Botley.

Hastings, Dec. 31, 1915.

Increased Toluene Production.

Sir,—In the issue of the "Journal" for Dec. 21, the writer of the article dealing with the above subject mentions the use of limestone as a method which has been suggested in the carbonization of coal to attain this object, and that he was intimately connected with experiments to find the effects of liming coal. From the description given, the experiments were in no way connected with increased toluene production, but with the production of metallurgical coke from semi-coking coals high in sulphur.

One point, however—viz., "that when limestone was used the ascension pipes were much freer of carbon during the tests"—shows that the limestone had produced some action by which the cracking of the hydrocarbons was prevented.

The use of limestone was put forward with the special object, when semi-coking and second-grade coking coals high in oxygen were used for the purpose, of retarding the evolution of the hydrocarbons which came off at the early period of carbonization, in order that these hydrocarbon vapours should take up the heat necessary for their formation into more stable compounds.

The writer of the article suggested that gas companies should reduce the temperature of carbonization in order to increase the production of toluene.

Many gas-works are at the present time working to the full capacity of their carbonizing plant, and other works are experiencing great difficulties in obtaining their regular supplies of coal. Any method which requires an increase in the quantity of coal to meet the daily demands of gas would, therefore, be quite out of the question. The use of limestone added to coal before carbonization renders available a lower grade of coal than has hitherto been used.

A series of trials has recently been made at one of our large gas-works on a sample of such coals, with and without the addition of limestone. Ten charges, each of 5 cwt., were carbonized—five coal only and five to which limestone was added. The gas was measured through a meter, and the calorific value determined by a calorimeter after the gas had been standing in the holder a sufficient time to become thoroughly diffused. The following results were obtained:

Coal as Received. Ash Content 26·9 per Cent.

	Coal.	Coal and Carbonate.
Average temperatures inside retort of five charges during carbonization	1081° C.	1099° C.
Results obtained per ton of coal:—		
B.Th.U. in gas made	4,535,600	4,984,900
Tar produced—gallons	6·29	9·26
Light oils in tar 0° to 170° C.—gallons	0·313	0·69
Toluene in gas—pounds	1·64	3·13
Toluene in tar—pounds	0·53	1·21

A. Rollason.

Nottingham, Dec. 31, 1915.

Gas Affairs at Ripon.

Sir,—Referring to the paragraph in your last issue, *re* the proposed extensions at these works. Will you kindly note that Mr. Matt Dunn, of Stockton, has nothing to do with these works. It should have read Mr. J. Wilfrid Dunn; and I shall be pleased if you will make the necessary correction.

H. F. Peeks, Manager.

Ripon Gas-Works, Jan. 1, 1916.

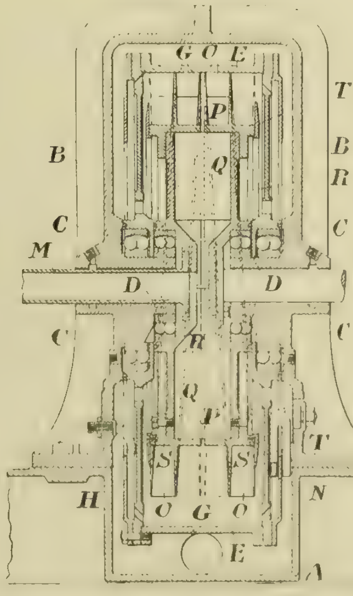
REGISTER OF PATENTS.

Rotary Compressor or Exhauster.

Johnston, J., and Globe Pneumatic Engineering Company, Limited, of Victoria Street, S.W.

No. 22,769; Nov. 13, 1914.

This rotary exhauster comprises two drum-like members arranged one within the other and eccentrically to one another, and having an annular liquid piston occupying the space between the members. The inner member is provided with one or more helical passages through which the gas being operated upon is forced from the inlet to the outlet side.



Johnston's (Globe Pneumatic Company) Rotary Exhauster.

In such devices, the patentees remark, it is well known that the degree of compression or exhaustion depends upon the amount of centrifugal force available for such operations in the liquid of the annular piston—this being determined for a given speed of rotation by the extent of the immersion in the liquid of the helical passage or passages. It has heretofore been proposed to increase the effectiveness of the machine by making the inner member tapered or conical, in such a manner as to increase the depth of immersion in the liquid of the helical passage through which the gas passes. But such a construction, they point out, suffers from the "grave disadvantage" that a wedging action takes place between the tapered member and the liquid, with the result that the outer casing is often subject to very great stresses, and may be liable to burst.

The object of the present invention is to devise a form of machine of the kind first referred to having the advantages of the second type of apparatus mentioned without its attendant disadvantages; and it consists in a machine of the type first above referred to comprising in combination an outer casing, an inner cylindrical rotary member having one or more helical passages thereon, and a shrouding plate formed or fitted upon one or each side of the inner member.

A transverse sectional elevation is given to illustrate one convenient form of machine in accordance with the invention—applicable more particularly as an exhauster.

A suitable form of foundation A has brackets B thereon for carrying the bearings C D of the outer and inner members respectively—the bearings being disposed symmetrically about the centre line of the machine (as shown) or else arranged so that the members may be overhung. The outer member is in the form of a hollow drum or casing, and the inner member is cylindrical in form and constructed in two parts Q, each of which is provided with two threads G, right and left handed, so that the gas to be extracted by the machine will be drawn through the hollow shaft M by way of the interior of the inner member and through the apertures P to be fed along the inner member to the outer surfaces.

The two parts Q of the inner member are connected by intermediate webs R, and the outer ring-like portions S, carrying the threads G, are secured to the members Q; and in order to provide for an increased effectiveness of the machine as regards the degree of exhaustion obtainable from it, shrouding plates T are provided on each side of the inner member, which, as already stated, is cylindrical in form, so that the plates will provide for an increased immersion of the inlet or outlet for the gas in the liquid of the annular piston, thus causing the gas to be acted upon by an increased centrifugal force and increasing the degree of exhaustion obtainable. The shrouding plates are made somewhat shorter than the stroke of the machine, in order to leave a discharge passage between their edge and the liquid piston at the outer part of the stroke.

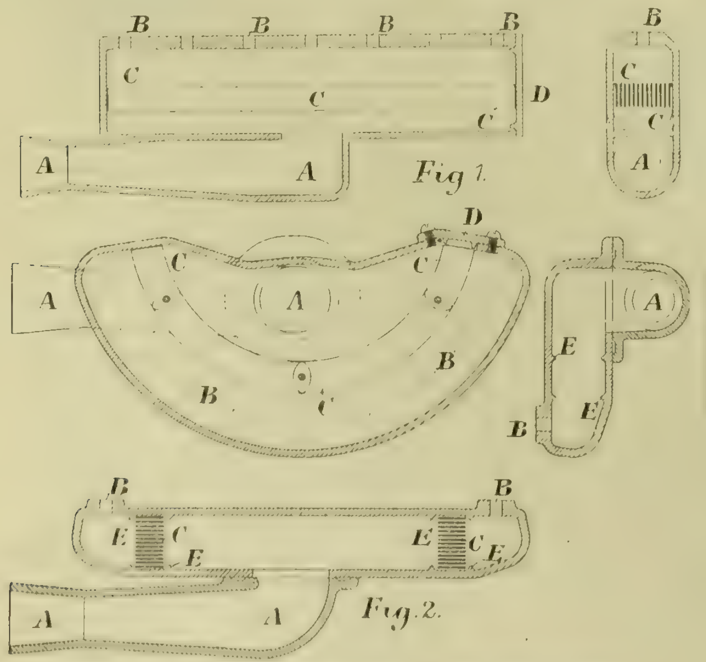
The liquid that is to form the annular piston may be introduced into the space between the two members by the nozzle H, and means are adopted for maintaining constant the amount of liquid within the machine, as, for example, by an outlet scoop N, arranged so that its position may be readily varied according to the quantity of liquid that is to be maintained within the machine.

Gas-Stove Burners.

Richmond Gas Stove and Meter Company, Limited, and Hartley, H., of Warrington.

No. 23,592; Dec. 5, 1914.

In the burner according to this invention a grid—composed of a plurality of relatively long plates or strips of metal or other solid material, arranged or spaced more or less closely to one another, and the depth of which is substantially greater than their distance apart—is so placed in the gaseous stream inside the burner that the plates are parallel with the direction of flow of the mixture from the inlet to the nozzles, and there is a space between the gas and air inlet and the grid, and between the grid and the gas discharge nozzles or holes at which the gas burns.



Hartley's (Richmond Stove Company) Gas-Stove Burners.

Fig. 1 shows a longitudinal and cross section of one modification, and fig. 2 is a plan, cross section, and longitudinal section of another one.

The burner is of the horizontal elongated type, the body of which is cast in one, and through the bottom of which the combined air and gas are introduced by a horizontal mixing-tube and conduit A. The roof of the body has a number of holes or nostrils B in it, at which the jets of gaseous mixture issuing through them will burn. The body of the burner has parallel sides, and is relatively deep to its width; and in about the middle of the body—that is, between the roof and the bottom—the grid device C is disposed, and extends from end to end, so that a space or chamber exists between it and the roof as well as one below.

The grid device consists of a multiplicity of relatively deep thin plates or strips of metal preferably placed closely together, the relative depth to the width of spaces being several fold. The grid is supported in the body; and all the plates are connected and yet held apart by pins or rivets, with washers between the plates. One end of the body is closed by a cap D, which, when removed, enables the grid to be introduced or removed. Fig. 2 shows the invention applied to a semi-circular burner. The grid here takes the general form of the outside of the burner body and the rows of burner apertures or nostrils B; and the grid bars in this case are in the horizontal plane, and lie within, and are held in place by, the ribs or projections E on the roof and bottom of the burner—they being introduced through a hole at one end of the burner, normally closed by the cap D. The gases in this case enter the body at the back, and then pass through the narrow spaces between the plates of the grid, and so to the space in the burner beyond it—in the roof of which the flame nostrils B are provided.

It is said that: "The effect of the invention is to enable a more even distribution of the gaseous stream through the burner to be obtained; to ensure the removal of violent eddies in the gaseous stream; and to enable a silent flame to be obtained over a wide range of aëration."

Manufacture and Use of Oil Gas.

Westrup, C. J., of Great Tower Street, E.C.

No. 345; Jan. 8, 1915.

This invention relates to apparatus used in the manufacture of oil gas consisting of a control valve mounted directly upon the emission end of the vaporizer in such a manner that the passage formed is uninterrupted by bends. In combination therewith is a cone-shaped orifice formed in a block adapted to be inserted within the open end of the supply pipe, and which block is capable of longitudinal adjustment within the pipe—being retained in the positions desired, after longitudinal adjustment, by set screws. Means are also provided for automatically controlling the supply of fuel to the vaporizer.

Economizing Valves.

Symes, G. V., a communication from the Fuel Economizer Company, Cleveland, Ohio, U.S.A.

No. 5198; April 6, 1915.

This apparatus is of the type wherein are provided two concentrically mounted rotary valves (one fitting inside the other); the outer or main valve being adapted to be operated by a lever, associated with a member which projects above the main gas-burner—the arrangement being such that the placing of a utensil over the burner depresses the member and causes the main gas-valve to open. The inner or auxiliary valve fitting within the main valve is manually adjustable.

The gas-valve comprises a rotary auxiliary valve mounted within the main valve and locked to it in one of certain selected relative positions by a member on the auxiliary valve adapted to engage with projections or slots upon the main valve, so that, after adjustment, the auxiliary valve moves with the main valve, whereby, in accordance with the adjustment of the auxiliary valve, the supply of gas to the burner is regulated independently of the movement imparted to the main valve by the displacement of the lever connected with it.

Oil-Gas Generators.

Mitchell, W., of Malden, Mass., U.S.A.

No. 5830; April 19, 1915.

The chief objects of this invention are to provide for the regular and efficient generation of oil gas and the perfectly even discharge thereof; to ensure its fixed dry clear character or quality; and to ensure the complete reduction into gas of all the gas-producing elements of the fuel without permitting any of the latter to become burned or baked before generation, and consequently accumulated on the walls of the generator. To these ends a generating retort is employed of the type having a sleeve-form elongated fuel-space which is thin at all points, but diminishes in the thickness of such space from its inlet to its outlet end, so that the walls of the space necessarily offer a continual increase of resistance to the gaseous flow—on somewhat the same lines as those described in Galkin's patent No. 5368 of 1902 and Gardiner's patent No. 8028 of 1912.

APPLICATIONS FOR LETTERS PATENT.

17,765.—Burt, E. M. S., "Gas-cooker." Dec. 20.
17,843.—Cwibel, B., and Hora, T. T., "Mantles." Dec. 21.
17,867.—Birch, G., "Inverted burners." Dec. 22.
17,894.—White, A. E., "Treatment of coal gas." A communication from the Riter-Conley Manufacturing Company. Dec. 22.
17,902.—Keith, J. & G., "Crucible furnaces." Dec. 22.
17,984.—Clarke, W. C., "Gas-cooker." Dec. 24.
17,993.—Hunter, T. M., "Atmospheric burners." Dec. 24.

MISCELLANEOUS NEWS.

SOUTH SUBURBAN GAS COMPANY'S CO-PARTNERS.

Message of the Directors.

The South Suburban Gas Company Co-Partnership Almanack for 1916 contains the following Directors' message (signed by the Chairman, Mr. Charles Hunt) to all the Company's co-partners.

The Chairman and Directors have again the pleasure of sending to all co-partners their best wishes for a New Year. May it bring happiness to all! May it restore to the nations the blessing of peace! Seventeen months of unparalleled warfare, chequered by atrocities that cry aloud for retribution, and must for ever stain the German name, have not shaken the unity of the Allies, nor their high resolve. On the contrary, the appearance of fresh enemies has but nerved them to fresh exertions with ever-increasing strength—a sure presage of final victory. We are all proud of the large number of the Company's employees who are taking part in this great war of liberation, and also of the heroic engagements in which many of them have shared. They have our earnest wishes for their continued safety and success, and for the complete recovery of those of them who have unfortunately been wounded. And we should be ungrateful indeed did we not acknowledge with reverence our deep indebtedness to those who have laid down their lives in fighting our battles. To those whom they have left behind, we tender heartfelt sympathy on behalf of all. The generous contributions to the War Fund of all classes of employees have much impressed the Directors, who gladly welcome this co-operation as an additional bond of union. They desire also to acknowledge the valuable services which are being rendered by the Special Committee of employees in administering the fund, which it is gratifying to know is proving a real benefit to the many dependants of those on active service.

LEEDS UNIVERSITY LECTURES.

Department of Coal Gas and Fuel Industries (with Metallurgy).

In connection with the work of the department, arrangements have been made by Professor John W. Cobb, B.Sc., F.I.C. (Livesey Professor) for the delivery during the second term of the session 1915-16 of the following special courses of lectures, open to all persons engaged in any branch of the industries concerned.

I.—THE CHEMISTRY OF COAL AND CARBONIZATION.

A series of six lectures by Professor John W. Cobb, B.Sc., F.I.C., will be given on Wednesdays, at 6 p.m. and 8 p.m., commencing Feb. 16, and continuing until Wednesday, March 1.

Coal—its origin and composition. Classification and valuation of coals in respect of their principal economic uses—*e g.*, for steam raising, gas making, furnace firing, manufacture of coke, &c. Recent investigation on the nature of the constituents of coal and the mode of occurrence of nitrogen and sulphur in coal. The influence of temperature on the carbonization of coal, with special reference to the character and yields of gas, ammonia, coke, and tar-constituents, including benzine and toluene.

II.—REFRACTORY MATERIALS.

A course of eight lectures by Professor John W. Cobb, B.Sc., F.I.C., will be given on Tuesday evenings at 6 p.m., commencing on Tuesday, Jan. 18.

Physical and chemical introduction. The properties and composition of the raw materials. The principles and methods of manufacture and testing. Silica, ganister, alumina, bauxite, kaolin, fire-clays, magnesia, chromite, graphite, dolomite. Grinding, grading, moulding, pressing, drying and burning, shrinkage, expansion and contraction, refractoriness. High temperature furnaces and testing. Choice and use of refractory materials for gas retorts and settings, coke-ovens, steel and metallurgical furnaces.

III.—EVENING LABORATORY COURSE.

The laboratory of the department will be open on Wednesday evenings between 6 p.m. and 9 p.m., from Jan. 19 to Feb. 9 inclusive, for a limited number of students, who have already received some chemical training, but who desire a knowledge of analytical methods for the estimation of benzene, toluene, &c., in coal tar and gas, and the examination of crude benzol and toluol.

[Attention is called to the possibility of attending both Courses I. and III.

IV.—DAY LECTURE COURSES, 1915-16.

For information respecting the day lecture courses in the Coal Gas and Fuel Industries Department of the University—namely, in chemistry of gases, technology of fuel, gas-producer practice, general and non-ferrous metallurgy, blast-furnace practice, iron and steel, alloys and metallography—see the special prospectus of the department, obtainable on application to the Secretary.

V.—ADMISSION OF STUDENTS, INQUIRIES, &c.

Intending students are requested to send in their names without delay to the Secretary of the University, specifying at the same time what course or courses they wish to attend. Other inquiries regarding the courses should be addressed to Professor Cobb, the Head of the Department of Coal Gas and Fuel Industries.

The University reserves the right to decide that any course shall not be given if the number of entries is inadequate, or if the technical services of the Department are further requisitioned for national purposes.

COLONIAL GAS ASSOCIATION, LIMITED.

The Treasury and the Association—Good Progress, but Revenue Temporarily Used for Capital Purposes.

The Ordinary General Meeting of the Association was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. Samuel Spencer in the chair.

The Secretary (Mr. Alfred J. Kingdon) read the notice convening the meeting and the Auditors' report; and the report and accounts [see "Journal" Dec. 28, p. 714] were taken as read.

The Chairman, in moving their adoption, said his first duty was to say, with the deepest regret, that since the last meeting they had lost their colleague, Mr. W. Swinburne. He was associated with the Company from its start; and his assistance was of the greatest benefit since his brother (the Hon. George Swinburne) left them. He became, as the shareholders knew, their Managing-Director. His loss to the Company was irreparable, as he was so much respected in Melbourne by all who knew him. The Board at once sent out their sympathy and condolence to his family; and he (the Chairman) was sure the shareholders would endorse what was done. The Directors were extremely sorry that the annual meeting was not held as usual, in the early part of November; but, through the war, they could not get the accounts over in time. Since then, and indeed only a few weeks before, the Directors were doing all they could to induce the Lords of the Treasury to allow them to make an issue of shares among the shareholders. This they had refused, although the Directors put the Company's position before them as strongly as they could—pointing out their commitments, in March of last year, as to the payment for the works the Company bought, as well as the expenditure incurred in bringing the works up to the last improvements in gas making. It was particularly pointed out to the Treasury, too, that some £4000 was spent on a new main, partly for the supply of a munitions factory in Melbourne. Why therefore the Treasury should have treated the Company so badly they could not understand. Their reply a fortnight ago suggested that the Company should obtain the capital in Australia. The Directors had informed them that this was an English Company, and about 70 per cent. of the shareholders were English; and they were now awaiting their final reply. At the annual meeting last year, they had had a year's working before the war; and the shareholders would remember it was a very prosperous one. In putting before them the present balance-sheet to the end of June last, he might say that eleven months out of the twelve were in the period of this outrageous and wicked war; but Australia had suffered less financial inconvenience than anywhere else. He thought it could be said of Australia to-day that it was prosperous, notwithstanding the severe drought it passed through in the early part of this year. Had it not been for the war, the Directors felt confident the balance-sheet for the past year would have been equally good, if not better. It was, however, in the opinion of the Directors a most satisfactory one, as the earnings enabled them to recommend a final dividend of 3 per cent., making 6 per cent. for the year. But this was tinged with much regret that the money was not available for immediate payment, owing to the circumstances he had previously mentioned. To get over this, they were having an extraordinary meeting at the close of the ordinary meeting, in order to obtain the sanction of the shareholders to the issue of 6 per cent. preference shares, which the Directors thought they would readily agree to, as the rate of dividend would be the same as they were paying on the ordinary shares for the present year, and which they quite anticipated would, in all probability, be increased in the coming year. He should like the shareholders to think the Company was one that should be considered an investment Company; and no better proof of this could be mentioned than that, during the past year, the transfers had only been eight, three or four of which arose from deaths. He wished to remind the shareholders that this was their twenty-seventh annual meeting, and dividends had from the first been paid half-yearly, during the months of April and November, without any break whatever. In turning to the balance-sheet, the shareholders would see that the profit they had to deal with was £6064. To pay the dividend now declared, less tax, required £4232, with a carry-forward of £1832, against £1774 last year. This, to his mind, showed a record that few gas companies at home or abroad exceeded. The shareholders would notice the Directors had written off for depreciation £1294; and they had increased the reserve fund (£8422) before arriving at the balance for the dividend now recommended. Regarding the new works, Footscray and Oakleigh, they quite expected great results, and felt confident they would not be disappointed, as the increased demand arose from 387 new consumers, and an addition of nearly 600 cooking-stoves. The returns for the current year—from June to November—showed a satisfactory increase of from 15 to 20 per cent. Fortunately, they were able to secure in Australia all the coal they required; and the price had not increased more than 5 to 10 per cent., and this arose principally from the distance of the works from the collieries. The two half-yearly voluminous reports from Australia were on the table, and could be seen by any shareholder desiring to examine them. They would be found as satisfactory to them as they were to the Directors. It might be of interest to the shareholders to mention that the capital account per million cubic feet of gas sold had been reduced during the past year by over £200. It stood at June 30, 1915, at £1338, against £1547 the previous year. To those who know the working of foreign gas companies, this was an exceedingly low figure. He felt convinced that in the near future they would be down to £1000 per million. He should also like to say regarding their fifteen gas-works that at several the price of gas had been reduced, and no increase had been made at any of them. Altogether, considering the extra cost of materials, higher wages, and taxes, the past year's working could only be considered as very good. In conclusion—it was perhaps unwise to prophesy—he did not hesitate to say with much confidence, that he anticipated this year would exceed in prosperity any year of the Company's history.

Mr. Charles Hunt seconded the motion, which was unanimously carried.

The Chairman moved the declaration of a final dividend of 3 per cent., less income-tax for the year ended June 30 last, making, with the interim dividend, 6 per cent. for the year—the final dividend to be paid as soon as funds were available.

The Hon. Sir John W. Taverner, K.C.M.G., in seconding, said he should like the shareholders to understand that what they had to bear in mind was what was said in the first paragraph of the report. The Directors had there been rather lenient with the Treasury; and as he was (so to speak) the Australian section on the Board, he felt very keenly indeed the "Little Englander" policy that was being pursued by the Treasury. Here was a gas company, which had been in existence 27 years, and had paid regular dividends; and just prior to the war the Directors accepted a responsibility in good faith that they would be able to get the necessary capital to carry out their contracts. This they would have done had it not been for the extraordinary policy adopted by the Treasury, who seemed to look upon Australia as not being part of the British Empire. Australia had volunteered service to the Mother Country in connection with the war. It had given money and the service of its men in a manner that had satisfied the bulk of the people of the Mother Country. It had been loyal, and had shown it wanted to be part of the Empire. And it was a most extraordinary, unbusinesslike, and stupid policy of the Treasury to try to make it appear that Australia was not within the Empire. Why he felt it much more keenly and strongly was that there were other interests in this country in connection with which the Treasury, without the slightest hesitation, sanctioned the issue of new capital. Only the other day they sanctioned £7000 to the German Athenæum Club; and they were allowing German interests to earn about three million pounds a year here. But British interests on this side of the water were told they might raise capital on the other side. Now Australia was under no obligation to the Mother Country so far as the war was concerned. Nevertheless, it pledged itself to raise fifty millions of money to help to fight the war to a successful issue; and he thought the Treasury was taking up an extraordinary and unimperial attitude. In effect, Australia was told that it was not part of the Empire—that it was 13,000 miles away; and the policy of the Little Englanders towards Australia was that it must "paddle its own canoe." Australia did not say this to the Mother Country. And because this Company were not allowed to raise the paltry amount of capital they asked for—and be it marked, capital required to carry out obligations entered into prior to the war—the Directors had to take from the shareholders what they were entitled to, and apply the profits to carrying out works that essentially belonged to the capital account. It was a small amount; but its smallness did not stand so much in his idea as the extraordinary policy of the Treasury of this country. He wanted to mention this in seconding the resolution, because the Company had earned the money to pay the dividend, the Company were solvent, the Company were doing well, but through this wretched, narrow-minded, red-tape administration of a few men who had no legal powers, and little knowledge of business, the Directors were obliged to tell the shareholders: "We declare a dividend; and, as soon as the funds are available, you will get it." "As soon as the funds are available" meant as soon as the Treasury would come down, and do the right thing. Then the Directors would at once pay the dividend.

Mr. D. T. Livesey said the "storm in a teacup" to which they had just listened struck him as rather curious. If he understood the position rightly, the very action of the Treasury brought Australia in as a member of the Empire. The Government were treating English firms and companies in the same way as they were treating this Company. If this were the case, then the argument was working on the other side. Instead of Australia being treated to a paltry, red-tape policy, the Treasury were simply treating Australia as the Mother Country was being treated.

Sir John Taverner: I was speaking in the interests of the shareholders, and not of foreigners.

Mr. Livesey: English gas companies are suffering from the same cause.

Mr. Hunt: Not English gas companies?

Mr. Livesey: Yes; English gas companies. While they were all sorry with regard to this state of things, they had to be patriotic in this matter. They had to be English, and Australia at the same time British; and all must do what they could. By postponing their dividend for a time (true, he was only a small shareholder), they were doing a little to help in the present crisis, and, in doing this little, were doing the best they could.

Mr. Hunt: Does Mr. Livesey know of any English gas companies who are in any way manufacturing munitions of war who are being refused sanction by the Treasury to raise money?

Mr. Livesey: No.

Mr. Hunt: We are doing that.

The Chairman said the Chairman of Barclay's Bank, who was a great financier in the City, said he could not understand this action of the Treasury; and he (Mr. Spencer) did not think anyone else could.

The motion was unanimously adopted.

Mr. F. R. Smith proposed the re-election as Directors of Messrs. Charles Hunt and Samuel Spencer. He remarked that Mr. Hunt brought with him to the Board a wide experience of gas affairs, and great technical knowledge of all the engineering details in connection with gas-works; and he was a source of much strength to the Board. They were glad, indeed, to have such an eminent engineer to advise them on technical points. As to their Chairman, they had had experience of his optimism at the present meeting. He inspired them all with his confidence. A Director from the inception of the Company, he had been Chairman for upwards of twenty-one years; and he (Mr. Smith) was sure they could wish for no better.

Mr. H. King Hiller seconded the motion, which was cordially agreed to.

The Chairman and Mr. Hunt having acknowledged the continued confidence of the shareholders,

On the motion of Mr. W. Richards, seconded by Mr. Livesey, the Auditors (Messrs. Wood, Drew, and Co.) were re-appointed.

The Chairman moved a vote of thanks to, and confidence in, the Australian Directors and staff. He observed that they had an experienced Chairman over there in Mr. Philip Holmes Hunt, who had had a fine training in this country, and then had been with the Melbourne Company for about ten years. He left the Company a little time ago, and had joined the Colonial Gas Association, and he was rendering them great service. Mr. S. E. Figgis, the Managing-Director, was elected last year. He was compensating to some extent the loss sustained through the death of Mr. W. Swinburne. In Mr. Figgis they had an excellent Director. Their fifteen stations required a good deal of looking after; and, the works being a long distance from each other, they could each be visited only a few times a year. But those in charge of the stations had the full confidence of the Board; and the work they did, as shown by the report, was entirely to their credit.

Mr. Hunt seconded the motion; and it was heartily agreed to.

Subdividing the Shares—Option of Shares for Dividend.

An Extraordinary General Meeting was then held for the purpose of (if thought fit) passing these resolutions as special resolutions:

(1) That each of the 50,000 ordinary shares of £5 each in the capital of the Company be subdivided into five shares of £1 each.

That of the shares subdivided as aforesaid and remaining to be issued 30,000 thereof be issued as preference shares, conferring on the holders thereof a preferentia dividend out of the profits of the Company of each year, at the rate of 6 per cent. per annum, and ranking as regards repayment of capital in priority to the ordinary shares.

That the Directors be authorized to issue the said preference shares as and when they shall think fit, and in such manner and upon such terms as they shall determine.

(2) That the following words be added at the end of Article 102, viz., "The Directors may, however, with the sanction of a general meeting, instead of paying any dividend to the members in cash, divide amongst the members in proportion to, and not exceeding, the value of the amount of dividend to which they would be entitled, any assets of the Company in kind, and in particular any unissued shares or any securities of the Company, or any shares or securities held by the Company."

The Chairman said he did not think it necessary to say much as to what was proposed by the resolutions, beyond that further capital was required for carrying on their very successful and satisfactory business with its excellent prospects, seeing that Australia from now must have abounding prosperity. He felt confident that shareholders and friends would come forward and take up the 6 per cent. preference shares in such amounts as would meet the present requirements. As he had already said, the prospects were such as would enable the Company to pay 6 per cent. or more on the ordinary shares, so that the preference shares now offered might be fairly looked upon as a sound investment. Several shareholders had already agreed to take 10 per cent. of what would be issued. An alteration of the £5 shares into £1 shares had been for a long time spoken about, and was especially asked for by the Australian shareholders, as £5 shares were not very much liked on the Melbourne Stock Exchange. In regard to clause 2 and the alteration to the Article of Association, No. 102, it was thought advisable to make the addition suggested; and the Directors would be pleased if the shareholders would agree to it. He moved that the resolutions, as read by the Secretary, be approved and adopted.

Mr. Hunt seconded the motion.

Sir Frederic Painter asked whether the voting power, one vote for each share, would apply to the £1 shares.

The Chairman: Yes.

Mr. G. May asked whether, in the event of the dividends being taken out in shares, would the dividend start from the time it should have been paid under ordinary circumstances, or from the time of the issue of the shares?

The Chairman said he thought that went without saying.

Mr. Smith said, if they paid the dividend in cash as the Directors hoped to do if they could get the shares issued, then the cash payment would be for the dividend which was being declared that day. If, on the other hand, they issued shares for the amount of the dividend, it would be the same as if they were issuing them for cash. However, it had not yet been decided whether or not the dividend should be paid in shares or cash. Of course, in the event of shares being taken, odd amounts of dividend would be paid in cash.

Mr. T. K. Griffin: What is the advantage of the subdivision of the shares? It seemed to him they were going to a great deal of trouble over this matter without deriving any advantage. Was the £1 share really more marketable on the Australian market than the £5 share? For the home market, he did not think that the £1 share would be of greater advantage than the £5 share.

The Chairman replied that two or three times when they had been placing shares, the Australian market had said that £1 shares would be better. When Sir John Taverner first joined the Board, one of his first inquiries was, "Why do you not have £1 shares, instead of £5 shares?" This was regarded by the shareholders as an investment Company, as was proved by the fact that they only had four transfers of shares this year. There was not another company in England of which he knew which showed anything like that. The shareholders simply held the shares until they died, or there had to be forced sale through liquidation or something of the sort. For an English company, it did not matter much whether the shares were for £5 or £1.

Mr. Shotter said he was a trustee. As such, he was not able to accept new shares instead of dividend. What was his position?

The Chairman: We should only allot them to you at your request.

Both resolutions were unanimously agreed to.

Sir Frederic Painter moved a vote of thanks to the Chairman and Directors, with whom, he said, the shareholders sympathized while sympathizing with themselves.

Mr. May seconded the motion, which was cordially passed.

The Chairman thanked the shareholders on behalf of the Directors and himself. The last three or four months—ever since they had been concerned about getting further capital—had been very anxious ones for them. Naturally they thought that they would have been able to go on the old lines, and that the shareholders would take up the new capital *pro ratâ*. However, they were getting over their difficulties as well as they could; and, after this meeting, the Board would feel stronger than before, because they knew the shareholders were backing them up.

RATES AND CHARGES IN VARIOUS TOWNS.

Comparative Statistics.

A copy of the annual tabulated statistics which for many years past ave been compiled by the Borough Treasurer of Preston is to hand; ut unhappily it no longer bears upon it the name of Mr. James arter. Since that gentleman's death, the work of preparing the gures has been undertaken by his successor at Preston, Mr. W. llison Davies; and as the result, there are now available particulars ith regard to the charges made for gas, electricity, and water, and rofits and losses on municipal undertakings, together with the rates evied, in a number of Provincial towns and some of the Metropolitan oroughs for the year 1915-16. There are on the present occasion 137 laces referred to, which is three more than last year. Six new entries ppear (Canterbury, Clitheroe, Haslingden, Middleton, Morecambe, nd Mossley); while figures for three towns (Devonport, Scarborough, nd Wallsend), which were given before, are omitted. The populaons range from 891,234 in Birmingham to 13,000 at Clitheroe.

Glancing over the statistics it is noticed that, of the places referred o, the rateable values are highest in Westminster (£6,862,627), Liverool (£5,004,907), Birmingham (£4,822,768), Manchester (£4,797,516), Kensington (£2,446,849), Leeds (£2 235,130), Sheffield (£2,059,213). They are lowest in Clitheroe (£51,624), Mossley (£65,974), Morecambe (£78,050), King's Lynn (£86,342), Haslingden (£90,047), Ilkeston (£90,339), Brighouse (£91,092), and Bacup (£91,844). The places ated at 9s. or over in the pound are: Birmingham, 9s.; Huddersfield, s.; Preston, 9s.; Stockport, 9s.; and Worthing, 9s.; Macclesfield, s. 1d.; Manchester, 9s. 1d.; and Salford, 9s, 1d.; Keighley, 9s. 2d.; Leigh (Lancs.), 9s. 2d; Nelson, 9s. 2d.; Rochdale, 9s. 2d.; West Bromwich, 9s. 2d.; and Wolverhampton, 9s. 2d.; Harrogate, 9s. 4d.; Stockton-on-Tees, 9s. 4d.; and Warrington, 9s. 4d.; Bacup, 9s. 6d.; Morecambe, 9s. 6d.; and Swansea, 9s. 6d.; Ashton-under-Lyne, s. 7d.; Brighouse, 9s. 8d.; Sheffield, 9s. 8d.; Bradford, 9s. 9d.; Stalybridge, 9s. 9d.; Chesterfield, 9s. 9½d.; Colchester, 9s. 9½d.; Hull, 9s. 10d.; Heywood, 9s. 11d; Walsall, 9s. 11d.; Batley, 10s.; Colne, 10s.; Leeds, 10s. 1d.; Rotherham, 10s. 1d.; Stoke, 10s. 2¾d.; Lowestoft, 10s. 3d.; Halifax, 10s. 4d.; Ilkeston, 10s. 4d.; West Ham, 0s. 7d.; Merthyr Tydfil, 10s. 9d.; East Ham, 11s. 1d.; Norwich, 1s. 6d. The towns which are rated at 5s. or less in the pound are: Oxford, 4s. 8d.; and Blackpool, 5s.

Out of the rents of property and profits transferred from municipal ndertakings, &c., the rates are reduced in the following towns to the xtent 6f 1s. or more in the pound: Yarmouth, 1s. 9d.; Nottingham, s. 5d.; Darlington, 1s. 3d.; Stafford, 1s. 3d.; Wallasey, 1s. 2½d.; Halifax, 1s. 1d.; Liverpool, 1s. 1d.; Rotherham, 1s. 1d.; Bradford, 1s. On the other hand, profits equal to only 1d. in the pound, r less, were contributed at Eccles, ¼d.; Mossley, ¼d.; Stoke, ¼d.; Heywood, ½d.; Kingston-on-Thames, ½d.; Colne, ¾d.; Eastbourne, d. (electric light and tramway profits to reserve fund); Newport Mon.), ¾d. (water, electric light, and tramway profits to reserve fund); West Hartlepool, ¾d. (electric light and tramway profits to reserve und); Accrington, 1d.; Bacup, 1d.; Brighton, 1d.; Canterbury, 1d.; Hammersmith, 1d.; St. Helens, 1d.

Out of the total of 137 places which are included in the list, about o contributed no profits to the reduction of the rates, though half-a-dozen of these earned profits which were carried to reserve. Another able sets forth 67 instances [in many cases, of course, the same towns which showed profits on some undertakings made a loss on others] in which the rates were increased in consequence of deficiencies resulting rom the working of one or more municipal trading undertakings. The largest of these deficiencies was at Bristol (£90,152); while Birmingham (£61,549) comes next, and Preston (£39,740) is third. In he case of Birmingham, £43,387 of the loss arose over the waterworks; but with Bristol and Preston the cause is not definitely stated —though presumably dock works were responsible. There were also water-works losses of £24,997 at Swansea, and £24,667 at Stockport. The only instance of a loss on gas is at Liverpool (£400), where the works concerned have since been taken over by the Gas Company. Deficiencies on account of electric lighting are, however, reported from Accrington, Bath, Heywood, Ilkeston, Ipswich, Kingston-on-Thames, Lowestoft, Middleton, Morecambe, and West Ham. At Bacup, 2s. 1d. n the pound was added to the rates by the loss of £8126 on the water undertaking. The deficiencies at Bristol caused an increase of 1s. 0½d., at Preston of 1s. 10¼d., at Heywood of 1s. 8d., at Harrogate of 1s. 6½d., at Ilkeston of 1s. 3½d., at Stockton-on-Tees of 1s. 3d.

The remaining section of the statistics deals with the charges made for gas, water, and electricity in the various towns. This shows that, for the places included, the net price of gas for domestic lighting supply is highest at Lowestoft, with 3s. 10d. per 1000 cubic feet; while Widnes remains lowest with 1s. 3d. per 1000 cubic feet, and a smaller rate for large consumers, engines, &c. The other towns in which the charge for gas for domestic lighting is 2s. or less per 1000 cubic feet are: Sheffield, 1s. 9d.; Sunderland, 1s. 9d.; Bath, 2s.; Belfast, 2s.; Burton-on-Trent, 2s.; Newcastle-on-Tyne, 2s.

The charge per Board of Trade unit for domestic supplies of electricity ranges from 6½d. (flat rate) at Bromley, 6½d. at Chatham, 6½d. at Hove, 6d. at Bournemouth, 6d. at Kingston-on-Thames, and 6d. at Oxford, down to 2½d. at Southampton, 2¾d. at Bury, 3d. at Accrington, 3d. at Belfast, 3d. at Birmingham, 3d. at Burnley (flat rate), 3d. at Hammersmith (flat rate), 3d. at Hyde, and 3d. at Stalybridge.

The charge for water for domestic purposes on a house of £15 rateable value is highest in Canterbury at 5s. 3d. in the pound; Middleton, 2s. 6d.; Bacup, 2s. 5¼d.; Lincoln, 2s. 4d. (within the city limits); and Leicester, 2s. 1d. The rate is 2s. in the pound at Birmingham, Bury, Harrogate, Haslingden, Heywood, Huddersfield, Leigh, Rawtenstall, Rochdale, and Rotherham. The charges are lowest in the following towns: Liverpool (within the city limits), 6d. in the pound; Southampton, 7d.; Worcester, 8d.; Worthing, 8d.; King's Lynn, 8¾d.; Brighton, 9d.; Hove,. 9d.; Leamington, 9d.; and Manchester (within the city limits), 9d. The charges are also less than 1s. in Bournemouth, Crewe, Gloucester, Oxford, Peterborough, Plymouth, Reading, Richmond (Surrey), Widnes, and York.

At Preston, the rates are 9s. in the pound; and they are relieved to the extent of 8¾d. in the pound by the profits transferred from reproductive undertakings. These profits are, however, far more than offset by the deficiencies, which it is calculated were the cause of increasing the rates by 1s. 10¼d. in the pound. The price of gas at Preston for domestic lighting is 3s. per 1000 cubic feet; of electricity, 5d. per unit; and of water, 1s. 6d. in the pound on £15 houses.

COAL SMOKE AND ECONOMY.

The following letter on the subject of "Coal Smoke and Economy" has been addressed by Dr. H. A. Des Vœux (the Hon. Treasurer of the Coal Smoke Abatement Society) to the "Yorkshire Observer."

The case for the abatement of the smoke nuisance in our cities has always been very strong from the point of view of national health and economy. While those considerations still apply, and in present circumstances with increased urgency, the case against the burning of crude coal to-day stands on even stronger ground—namely, that of national safety. At the present moment the coke-ovens and gas-works of the country are doing their utmost to supply the Government with their enormous requirements of the raw materials—such as toluol and benzol—for the manufacture of high explosives. These materials are obtained from the tar which is extracted from the gas after it leaves the ovens and retorts. When coal is burnt crudely on the domestic hearth, in the kitchen fire, or under the factory boiler, all chance is lost of recovering these vitally necessary materials, as they then, with other tarry and sulphurous vapours, pass up the chimney to darken our skies, deteriorate our buildings, kill our vegetation, and contaminate our lungs.

It is estimated that of the coal raised and consumed in this country no less than 66 million tons (or rather more than one-third) are consumed in factories, and 34 million tons in domestic grates. As each ton of coal contains from 20 to 30 lbs. of sulphur (from which that valuable fertilizer of the soil, sulphate of ammonia, can be made), and from 10 to 11 gallons of tar (from which the raw materials for high explosives, as well as other valuable materials, are obtained), it is clear that both in the factory and in the domestic fire the waste of these substances is very great. To this must be added—a point on which stress has often been laid—the inefficient combustion of the coal itself. Waste at any time is deplorable; but in these days when labour is at a premium, when economy is being raised from a virtue to a necessity, and, above all, when this particular form of waste deprives our fighting men of that superabundance of explosive material which would help to shorten the war, it is more than deplorable—it is criminal.

Owing to the failure to appreciate the work of economic value which has been performed for many years by the Coal Smoke Abatement Society, subscriptions since the war have fallen off to such a degree that we have had seriously to curtail expenditure, and to discuss the possible closing-down of the Society. A due evaluation of our past would have shown that it is in no small measure owing to the remarkably successful propagandist work of the Society in arousing and stimulating interest in all forms of smokeless heating, that high explosives are now available in such large quantities—quantities which might have been immensely increased had our teaching not fallen on so many deaf ears.

EXPORTS OF SULPHATE OF AMMONIA.

Further Correspondence in the "Times."

Extracts were given on p. 717 of last week's issue from letters which had been appearing in the "Times" on the subject of exports of sulphate of ammonia and the requirements of home farmers. One of the correspondents was Mr. Roger W. Wallace, who urged that the sulphate of ammonia exported to Holland is not for agricultural purposes, but for the manufacture of high explosives in Germany. To this Mr. D. Milne Watson (Chairman of the Sulphate of Ammonia Association) replied that "Mr. Roger Wallace has apparently not heard of the success of the Haber process in Germany, and implies that synthetic nitrogen is only being made to a large extent in neutral countries. The facts are otherwise. The Badische Company are at the moment, according to their own account published in German newspapers, producing at the rate of 300,000 tons of sulphate of ammonia per annum, and in view of the increase in the production of cyanamide in Germany, it seems more than probable that the German claim that they are independent of nitrogen from outside sources is perfectly correct."

A further letter from Mr. Roger Wallace was published in last Wednesday's issue; and in the course of it, he said: "Mr. Watson suggests that I have not heard what has been done recently in Germany in the manufacture of synthetic nitrogen. I have always been interested in these products (although I have not made them commercially) since I put down the works for the Gas Light and Coke Company which secure him the position he holds as present Chairman of the Association. Recently in my own laboratory I have tried all the known processes, and others. Mr. Watson gives the figures of the output of a German Company for and against whom I often acted as Counsel, and consequently have not forgotten their claims. It is well, however, to bear in mind that it is essential for the German Government to show that it has enough home material to make its own explosives without having recourse to imports. It is a part of the Press campaign. Mr. Watson sums up by saying: 'In view of the increase in the production of cyanamide in Germany, it seems more than probable that the German claim that they are independent of nitrogen from outside sources is perfectly correct.' Now, Mr. Watson ought to know that cyanamide is made from carbide of calcium, which is not made in Germany, except in very small quantity, but is practically all imported. This ought to be stopped, as well as the cyanamide. Sulphate of ammonia has been the saving of the German agriculturist; and I hope it will not be also of its explosive manufacturers. If the Board of Agriculture stops the export to enemy countries, it could help the farmers to buy the excess; and Mr. Watson's Association would gain now and in the future by having a more extensive demand for their commodity."

TECHNICAL INSTRUCTION IN THE GAS INDUSTRY.

A Report Forwarded to the London County Council by the Education Committee.

The London County Council have formally received a report—forwarded to them by the Education Committee—of H.M. Inspectors of Technical Instruction relating to the Gas Industry in the Administrative County of London, for the period ended July 31, 1914. The Inspectors are Mr. A. Schwartz, H.M.I., and Mr. J. W. Helps, M.Inst. C.E. It was pointed out by the Board of Education that the report [some of the main portions of which are now produced] deals with the extent to which use is made of existing provisions for technical instruction, and with the efficiency of the instruction given at certain institutions, and makes suggestions for the training of gas-fitters' apprentices and students of gas engineering and manufacture. The Board added: "The report does not call for any special action on the part of the Council at the present time, except in regard to the directions in which future developments should take place. We understand that there is always a dearth of competent gas-fitters; and any schemes of technical training likely to improve the general efficiency are, therefore, most desirable. A conference has been held between the Council's officers and representatives of the Institution of Gas Engineers; and we have had before us the views of the Advisory Committees and governing bodies of various Institutions interested in the matter. Detailed proposals for classes in gas-fitting for both junior and senior students will be considered in connection with the arrangements for the session 1915-16."

INTRODUCTORY.

The total number of males employed in the industry in England and Wales is 73,547. Their classification according to age and type of work is given in the following table:

—	Under 18 Years of Age.	Over 18 Years of Age.
Engaged in gas works, distribution, and public services—		
Wage earners	1,796	63,161
Salaried persons	332	6,692
Engaged in tar distillation and ammonia works—		
Wage earners	47	1,471
Salaried persons	—	48
Total	2,175	71,372

In recent years the gas undertakings have pursued a forward policy in the matter of gas supply; and they have taken the work of installation on the consumers' premises largely into their own hands. As an outcome of this policy, the undertakings are beginning to feel the need of well-trained artizans to carry out the work of gas supply, and also of a better class of man with good technical knowledge who can be entrusted with the work of negotiating with consumers and advising as to their technical requirements. In this connection, the Gas Light and Coke Company, in co-operation with the London County Council, established in 1908 a scheme for the training of their apprentices. The successful operation of this scheme has led other companies to move in the same direction.

The industry is a well-organized one; the technical side being represented by the Institution of Gas Engineers and the Society of British Gas Industries, and the commercial side by the British Commercial Gas Association. There are also fifteen Provincial Gas Associations in Great Britain and Ireland, together with six Junior Associations.

GAS UNDERTAKINGS IN THE ADMINISTRATIVE COUNTY OF LONDON.

There are in all 35 companies which supply gas under statutory powers in the area known as "Greater London." The County of London is supplied with gas mainly by three Companies, known as the "Metropolitan Gas Companies." These Companies also supply areas outside the county. The three Companies are the Gas Light and Coke Company, the South Metropolitan Gas Company, and the Commercial Gas Company. Other Companies supplying in the County of London are the Brentford Gas Company, the Wandsworth, Wimbledon, and Epsom Gas Company, and the South Surburban Gas Company.

Gas Light and Coke Company.—Total area of supply, 125 square miles; approximate area of supply in the County of London, 43 square miles, comprising Hammersmith (northern part), Fulham, Battersea (northern part), Kensington, Chelsea, Paddington, Westminster, Lambeth (northern part), Hampstead, St. Marylebone, St. Pancras, Holborn, City of London, Finsbury, Islington, Stoke Newington, Hackney, Shoreditch, Bethnal Green (except a small part in the south-west).

South Metropolitan Gas Company.—Total area of supply, 51·5 square miles; approximate area of supply in the County of London, 50·5 square miles, comprising Battersea (southern part), Clapham, Streatham (except a small part in the south-west), Lambeth (main part), Southwark (except a small part in the west), Camberwell (main part), Lewisham (eastern part), Deptford, Greenwich, Woolwich.

Commercial Gas Company.—Total area of supply, 7 square miles; approximate area of supply in the County of London, 6·5 square miles, comprising Stepney, Poplar, and small portions of Bethnal Green, Shoreditch, and Hackney.

Wandsworth, Wimbledon, and Epsom Gas Company.—Total area of supply, 41·5 square miles; approximate area of supply in the County of London, 7·5 square miles, comprising Putney (eastern half) and the old parish of Wandsworth.

South Suburban Gas Company.—Total area of supply, 98·5 square miles; approximate area of supply in the County of London, 5 square miles, comprising the western half of Lewisham and small parts of Camberwell (south) and Lambeth (south-east).

Brentford Gas Company.—Total area of supply, 49 square miles; approximate area of supply in the County of London, 4 square miles, comprising Hammersmith (main part), Putney (western part), and Fulham (a very small part in the north).

EXISTING PROVISION FOR TECHNICAL INSTRUCTION IN SUBJECTS CONNECTED WITH THE GAS INDUSTRY IN THE COUNTY OF LONDON.

There are six Institutions in London in which instruction is given in evening classes in subjects connected with the gas industry, and one Institution in which part-time day and evening courses are held for the training of gas-fitter apprentices. No clear distinction at present exists between the subject-matter of the classes in "Gas Engineering" and "Gas Manufacture;" and the classes in "Gas Supply" and "Gas Fitting" are practically identical so far as the practical work is concerned. Part-time day and evening courses, extending over six years, are held at the Westminster Technical Institute, for apprentices of the Gas Light and Coke Company.

EXTENT TO WHICH USE IS MADE OF THE EXISTING PROVISION FOR TECHNICAL INSTRUCTION.

Number of Employees of Various Grades in the Gas Industry in London.—The total number of men employed by the Gas Light and Coke Company, the South Metropolitan Gas Company, the Commercial Gas Company, the Wandsworth, Wimbledon, and Epsom Gas Company, the Brentford Gas Company, and the South Suburban Gas Company is 25,872. It has not been found possible for the purpose of this report to determine the number of the men in the employ of these undertakings engaged in work within the Administrative County of London; but the following table gives an analysis of the various types of work and the total number of men employed in each grade by the six undertakings mentioned above.

Type of Work.	Number of Men Employed.
Works Department:—	
Engineers and assistants	99
Chemists	103
Draughtsmen	43
Foremen	390
Mechanics	3,225
Unskilled and low-skilled men (including stokers).	10,299
Learners and apprentices	105
Total for Works Department	14,264
Distribution Department:	
Inspectors	443
Foremen	382
Fitters and Mechanics	3,406
*Unskilled and low-skilled men	2,400
Learners and apprentices	483
†Public service men	1,956
Total for Distribution Department . .	9,070
‡Clerical Staff (all departments)	2,538

* Some undertakings employ contractors for mainlaying—such labour is not included.

† Includes lamplighters and maintenance men.

‡ Includes collectors.

Courses of Training for Employees of Various Grades.—In the table given below, the various grades of employment are grouped under four heads. For each group the total number of employees is given, and the type of training available in London at the present time is indicated. The number of Institutions in which the instruction is given and the number of individual students attending classes in which the instruction given bears directly upon the gas industry are also shown.

Group.	Grade and Type of Employment.	Number of Employees.	Course of Training.	Number of Institutions in which Instruction is given.	Number of Individual Students.
A	Managers, engineers, chemists, heads of departments, draughtsmen	245	(i) Full-time course at University or Technical College	9	..
			(ii) Evening classes in Gas Manufacture and Engineering	2	91
B	(i) Learners and apprentices	588	(i) (*a*) Part-time day and evening courses	1	110
	(ii) Foremen, mechanics, gas fitters, public service men, and inspectors	9,802	(*b*) Evening classes in Gas Fitting	2	80
			(ii) Evening classes in Gas Supply	3	392
C	Unskilled and low-skilled men	12,699	Evening classes in L.C.C. non-vocational Institutes	11	..
D	Clerical staff	2,538	Evening courses in L.C.C. Commercial Institutes	25	..

The number of students connected with Group A undertaking a full-time course of training before entering the gas industry is probably a very small one. A considerable number of persons in Group B probably attend evening classes in mechanical engineering subjects in the various Polytechnics and Technical Institutes in London. These attendances are not included in the statistics given. In a similar manner, a considerable number of employees in Group D are probably attending courses in Commercial Institutes. There is no evidence to show that persons employed in Group C are attending non-vocational classes to any considerable extent.

REPORTS ON EXISTING CLASSES AND COURSES.

Battersea Polytechnic.—Provision is made in the prospectus issued by the Polytechnic for lecture classes in gas supply, grade I. and final; and it is stated that a practical class will be formed in connection with these if sufficient students should make application for it. Of these classes, the lecture class of Grade I. is the only one that has been held during the current session. It is attended by six students, all of whom are connected with the gas industry.

Goldsmiths' College.—Classes are held in gas supply, Grade I. and final, and grouped courses have also been arranged in this subject extending over two years, as follows: First Year.—Practical mathemathics, machine drawing, gas supply (Grade I.). Second Year.—Practical mathematics, building construction, gas supply (final). The number of students enrolled in the class for gas supply (Grade I.) is nineteen, of whom eleven are taking the grouped course of the first year. The number of students in the final class in gas supply is 3, all of whom are taking the grouped course of the second year. The age range of the students is 17 to 33, and the average age is 22. The students reside in the districts in the vicinity of the College. All are connected with the gas industry.

Polytechnic, Regent Street.—Classes in gas engineering have been held at the Regent Street Polytechnic since 1888. During the past five years the chemical aspect of the subject has been developed, and now forms part of the work in the higher classes. Classes are held in gas engineering and manufacture, Grade I. and final, and in the chemistry of gas manufacture, as an adjunct to the final class in gas manufacture. The number of students enrolled is: Gas engineering and manufacture (Grade I.), 35; gas engineering and manufacture (final), 23; chemistry of gas manufacture, 24. The students, with few exceptions, are directly connected with the gas industry. In the class of Grade I., the lowest age is 17 years; and one-third of the students are 25 years of age and upwards. In the class for the final examination, the lowest age is 18 years; and rather more than one-third of the students are 25 years of age and upwards.

Westminster Technical Institute.—The classes in gas supply and manufacture are organized in two main sections: (*a*) Part-time day and evening courses for the gas-fitter apprentices of the Gas Light and Coke Company. (*b*) Evening classes in gas supply, gas engineering, and gas manufacture for students other than those attending under the Gas Light and Coke Company's scheme.

The part-time day and evening courses for the gas-fitter apprentices of the Gas Light and Coke Company were established in 1908 by the Gas Light and Coke Company in co-operation with the London County Council. Their object is to afford a graduated course of training for apprentices in the employ of the Gas Light and Coke Company. The theoretical portion of the training, together with special instruction in gas supply, is carried out in part-time day classes and in evening classes held at the Westminster Technical Institute. The practical training is carried out on the Gas Company's premises in Horseferry Road, in workshops which have been specially equipped for the purpose. The course of training extends over a period of six years. The total number of students in attendance at these courses at the present time is 110.

The Gas Light and Coke Company take into their service for training about twelve lads every six months. Applications for entry to the course are invited by the London County Council from pupils attending public elementary schools in the district; and these applications are submitted to the Gas Company. Applications are made also direct to the Gas Light and Coke Company by sons or relatives of the employees of the Company. The age-range of the students is from 14 to 20 years. The Gas Company pay wages to the lads in training at the rate of from 2s. 6d. per week in the first year to 22s. 6d. per week in the final year of their apprenticeship.

The work done at the Westminster Technical Institute throughout the course averages 5½ hours per week for about 40 weeks per annum. It includes instruction in technical calculations, technical drawing, English, elementary mechanics and physics, and gas supply. The courses of instruction are as follows:—

First Year.—Attendance for three afternoons (9 hours) each week at classes for technical calculations, drawing, and English.

Second Year.—Attendance for one whole day (6½ hours) each week at classes for technical calculations, elementary mechanics and physics, and English.

Third and Fourth Years.—Attendance for two evenings a week (4½ hours) at classes for gas supply and English, and at a short course on the wiping of lead joints. The latter course is held in the day time, and involves attendance for 44 hours per week for seven weeks.

Fifth and Sixth Years.—Attendance for two evenings a week for more advanced work in gas supply and English.

The classes held in the daytime are restricted entirely to apprentices in the service of the Gas Light and Coke Company; but those held in the evening are open to all comers.

The curriculum followed in the day classes is a well balanced one, and is suited to the requirements of the lads. Excellent work was seen in technical calculations and drawing; but the instruction in physics and mechanics requires strengthening. Care should be taken to see that the lads understand clearly the fundamental principles which the experiments that they perform are designed to illustrate; and more responsibility should be placed upon the boys than is the case at present in connection with the arrangement and performance of the experiments.

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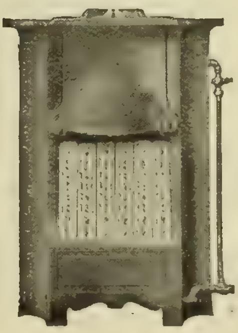

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employed, might be added with advantage. The workshop is well furnished with tools and appliances, which have been supplied by the Gas Light and Coke Company. Special attention is paid to the teaching of English throughout the course, and an attempt is made not only to give to the lads a command of their mother tongue, but to foster in them a love of good literature, and to instruct them in the duties and rights of citizenship.

The training in practical work, which is carried out in the workshop in Horseferry Road, and in connection with installation and repair work in the district, is apportioned as follows: Twelve months in training workshop for 36 hours per week; eighteen months on gas work in the district as assistants to fitters; twelve months as fitters' mates; six months meter testing; six months mantle maintenance; six months as fitters; six months in show-room; three months in offices; three months estimating.

The training workshops at Horseferry Road comprise a store-room, polishing and lacquering shops, brass and tin shop, general training shop, and carpenter's shop.

The scheme of the Gas Light and Coke Company for the training of their apprentices is probably the most complete of its kind in the United Kingdom, and affords a notable example of the beneficial results obtainable by wise co-operation between a great industrial concern and the local education authority. All concerned are to be congratulated on the important results already achieved and on the promise of development in the future. In considering the line of future development, it may be well to have regard to the principle of selective rejection of students at definite stages throughout the course, as may be shown to be necessary by the examination results and reports of the school authorities and the reports of the foremen and officials at the works.

As to the evening classes in gas supply and manufacture, these are held in gas supply for two grades of examination. An intermediate course has also been arranged for students who have already given some attention to the subject of gas supply, but who are not sufficiently advanced to profit by attendance at the senior class. Classes are held also in gas manufacture and gas engineering; and special courses consisting of three lectures on refractory materials and gaseous combustion have been given during the current session by experts.

As stated previously, the apprentices of the Gas Light and Coke Company attend the evening classes in gas supply as part of their course of training; figures for the attendance of these apprentices are not included in the statistics given below. The total number of enrolments for the classes in gas supply, manufacture, and engineering for the current session is 481. The age-range of the students is from 15 to 21 years and upwards; the majority of the students being over 20 years of age. Except in a few instances, the students are employed in the gas industry. A class in technical calculations and drawing is held in connection with the classes in gas supply and gas manufacture, and is attended by 58 students out of a total enrolment of 294 students in the classes for gas supply and manufacture.

The instruction in gas supply, Grade I., consists of a lecture and class work of 2¼ hours' duration on one evening; a second evening being devoted to workshop practice. The lecture is attended by 281 students, of whom 100 attend also the class for workshop instruction. The lecture classes are held in two sections; but even when divided in this way, they are too large to allow satisfactorily of informal discussions and the interchange of question and answer taking place in class. The gas supply class of intermediate grade is attended by 11 students, who devote 2¼ hours on one evening per week to class work and laboratory work in gas supply. The instruction in gas supply, Grade II., consists of a lecture and class work of 2¼ hours' duration. The class is attended by 71 students. A second evening per week is devoted to a class in laboratory work, which is attended by 27 students. The laboratory class is intended specially for students who have already passed the final examination in gas supply. The experiments undertaken in this class are of an advanced nature; but the students for the most part are not well prepared to carry them out, owing to their lack of preliminary training in experimental science. Considerable additional laboratory accommodation is needed, if the work is to be placed on a sound footing.

The class in gas manufacture is attended by 13 students. It is associated with a short course in gas engineering, which consists in part of lectures and in part of laboratory work. There are 20 enrolments for the short course.

London County Council School of Building, Brixton.—Evening classes are held, at the Brixton School of Building, for gas-fitter apprentices employed by the South Metropolitan Gas Company. Classes of two hours' duration are held on three evenings a week throughout the session in workshop arithmetic, iron pipe work (workshop), and elementary building construction and drawing. The total number of students in attendance at the course is 60. They are divided into three sections of 20 each for work in the class-rooms and workshop. The workshop has been well equipped with apparatus by the South Metropolitan Gas Company, and some experimental apparatus has been erected by the students.

The classes were started only at the commencement of the current session, and are evidently meeting a need of the locality. It is hoped that in the future these classes may develop into a part-time day course for gas-fitter apprentices, similar to that at the Westminster Technical Institute.

South Grove Junior Technical Institute, Stepney.—Evening classes in gas-fitting were started at this Institute in November last. The classes are attended by 20 students; and the age-range is from 14 to 18 years—the average being 15·7 years. The classes are held on three evenings a week throughout the session, and instruction is given in English, trade workshop, trade lecture and calculations, and gymnastics.

General Observations and Suggestions.

Influence of External Examinations upon the Teaching.—A consideration of the reports on the individual schools shows that the teaching in

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connection with the gas industry in London is very largely influenced by the system of external examinations at present in vogue.

There is no doubt that this system of external examinations presents certain advantages. It secures uniformity of syllabus and of aim in detached classes; and by the issue of certificates of various grades, it provides a stimulus to the students and to the teachers in their work, and affords a basis upon which some recognition of training can be made by employers.

On the other hand, any system of purely external examination is liable to grave abuse. The passing of the examination is almost invariably made the aim of the instruction; and the teaching throughout the course is distorted by this consideration. The external examination in gas subjects can be passed most easily upon work of a descriptive character, and, in consequence, an undue emphasis is placed in the teaching upon a knowledge of things, to the neglect of a knowledge of principles and skill in thinking. This neglect of fundamental principles is further accentuated by the fact that the examinations in connection with the gas industry are restricted to the trade subject, and satisfactory attendance and work in classes in related science subjects is not required.

The following suggestions are made with a view to indicating the lines upon which improvement may be effected:

(*a*) The formation of "grouped courses," involving instruction in the trade subject and in the science subjects related to it. Distinct courses should be formed to meet the requirements of various grades of students.

(*b*) The establishment of internal examinations in the individual schools. The examinations to be conducted by the teachers concerned, in conjunction with one or more external assessors who would act for the whole of London.

(*c*) The issue of awards and certificates based upon—
  (i) The results of the examinations;
  (ii) The results of the home work, class work, and practical work done during the session;
  (iii) Reports by foremen and employers on conduct and progress in the workshop or office.

The establishment of a scheme of internal examinations on these lines would conserve the advantages already enumerated in connection with the existing system of external examinations, and would at the same time greatly increase the efficiency of the teaching.

Suggested Training for Gas-Fitter Apprentices.—The following alternative methods of training gas-fitter apprentices may be considered:

(*a*) Part-time day and evening courses of instruction extending over five or six years held in a Technical Institute, with special instruction in practical work given in the works during the period of apprenticeship.

(*b*) Full-time attendance for a period of two years at a day course in engineering at a Junior Technical School, prior to apprenticeship, followed by a period of apprenticeship for four years, during which special instruction would be given in practical work on the works.

(*c*) Attendance at grouped courses of instruction in evening classes extending over a period of two years during the period of apprenticeship, with concurrent instruction in practical work given on the works.

Part-Time Day and Evening Courses.—In addition to the Westminster Technical Institute, where a scheme of this type is already in operation, there would appear to be need for a centre of instruction in the North or East of London, and for one in the South-Eastern district. Attendance at the course should be made contingent on the satisfactory progress of the student from year to year, as judged by the reports of the school authorities and of the works officials.

Full-time Day Training at a Junior Technical School.—Of the three alternatives presented, this scheme would probably yield the best results. There are already established in various parts of London seven Junior Technical Schools giving a general training in engineering suited to the needs of students who will ultimately become skilled workmen. All that is needed, therefore, to put this scheme into operation would be co-operation between the gas companies and the school authorities to regulate the number of students in training who are desirous of entering the gas industry, and the establishment of definite courses of training in practical work during the period of apprenticeship.

Grouped Courses of Instruction in Evening Classes.—This method of training is the least satisfactory of the three methods referred to, owing to the limited time available for the purpose of instruction, and the adverse condition under which the instruction is given. The courses should extend over three nights per week, and instruction should be given in trade methods and calculations, workshop drawing, and workshop practice. The results obtained in the evening courses might well be used for selecting students for subsequent attendance at part-time day courses.

Suggested Training in Gas Engineering and Manufacture.—For young men intending to make gas engineering their profession, a full-time day course in the engineering faculty of one of the Universities, or in one of the larger Technical Colleges, is desirable. Ample facilities exist in London and elsewhere for full-time courses of this character. For students who are not able to undertake a full-time course of training, part-time day courses or evening courses should be arranged extending over four or five years. The evening courses should take the form of grouped courses held on three nights a week, and should include ample provision for instruction in mathematics, physics, chemistry, and engineering drawing, in addition to instruction of a technical character relating to the gas industry. Throughout the course an intimate relationship should be maintained between lecture and laboratory work, and as much emphasis as possible should be placed upon instruction in the laboratory. A system of certificates in connection with internal examinations should be established for these courses.

Organization for Future Developments.—Up to the present time, the

Our "THERMO-X" GAS-FIRES

And "EUREKA" COOKERS

are being

REGULARLY SUPPLIED

by us to the various

GUN AND SEARCHLIGHT STATIONS

on the orders of

H.M. Office of Works.

JOHN WRIGHT & CO.,
Essex Works,
BIRMINGHAM.

part-time day courses and evening courses relating to the gas industry in London have been established by the co-operation of individual gas undertakings with the local education authority or with the authorities of individual schools. These courses have been developed successfully; and a point has now been reached where the requirements of the gas industry in London in relation to the educational facilities of the country should be considered as a whole. It would appear to be desirable, therefore, that some representative body—such as the Institution of Gas Engineers—should co-operate with the local education authority for London in the provision of effective training for employees in the gas industry of the Metropolis.

NOTES FROM SCOTLAND.

Cheapest Gas in Scotland.—In sending an intimation that, as from the 1st inst., the price of gas in Coatbridge "to all classes of consumers" will be reduced by 3d. per 1000 cubic feet, the Interim Secretary and Treasurer of the Coatbridge Gas Company (Mr. David Lambie) writes that this will make the charge for lighting 2s. per 1000 cubic feet, "which is considerably cheaper than the rate charged by any other undertaking in Scotland."

Public Electric Lighting at Hawick.—The public electric lighting at Hawick is evidently far from all it might be. At a recent meeting of the Town Council, the Town Clerk reported that he had been instructed to write to the Urban Electric Company about the defective street lighting; and he read a letter in reply, regretting the complaints, but pointing out that the nature of the complaints was not mentioned. One member remarked that there were nothing but complaints; and another said that the light of the lamps just made darkness visible.

Economizing in Edinburgh.—The City Chamberlain of Edinburgh (Mr. Robert Paton) has issued a report on the reductions which are being effected in the city's expenditure, and on the possible changes in administration which may be submitted for the consideration of the Town Council, with a view to ascertain what permanent economies may be carried out after the war is ended. In his introduction, he points out that the total number of employees who have gone on war service up to date is 830. At the present time, the total member of employees in the service, including temporary men, is 1842, as compared with a total authorized strength of 2491. Considerable reduction is being effected in the cost of lighting, and in the cleansing department. There is, he says, room for the permanent curtailment of expenditure under the heading of public lighting. The restricted lighting last winter demonstrated how small the actual minimum necessities of the city are. The over-illumination of pre-war days arose from the fact that the old flat-flame burner was replaced by the incandescent mantle—that is, 45-candle power was substituted for about 5-candle power—while the distances between the lamp-posts remained the same. In the case of most of the streets, it will be found that one-half the number of lamps will provide a sufficient measure of lighting. This would represent a saving of about £7500 per annum in wages and in gas consumed. A further saving may be effected by a system of automatic lighting. The restricted lighting by electricity both last winter and this winter has shown that there is also room for reduction of the expenditure under this head. From £1500 to £2000 per annum could be saved in this way. The substitution of gas or electricity for coal, in the matter of heating the various properties of the Corporation, is suggested as worthy of consideration.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 3.

The market for tar products is quiet, and there is nothing of particular interest to record. From time to time, boats of one description or another are found, so that shipments of pitch continue, if somewhat slowly. The present values range from 19s. to 19s. 6d. per ton net, at makers' works. Other values are: Creosote, 4⅛d. to 4¼d. per gallon, in bulk; 90-160 solvent naphtha, 2s. 2d. per gallon, naked; 48-50 per cent. anthracene, 2¼d. per unit, casks free; 60's crude carbolic, 3s. 4d. per gallon, naked; pure toluol, 3s. 4½d. per gallon, naked—all at makers' works, net cash.

The demand for sulphate of ammonia continues good, and values are very firm—£17 5s. per ton net, into buyers' bags, at makers' works, is reported as having been paid for 25 per cent. quality down to June next.

Tar Products in the Provinces.

Jan. 3.

The markets for tar products remain about the same. There is nothing fresh to report concerning pitch. Offers are still being made at reasonable prices; but the difficulty in securing freights prevents the concluding of the transaction. Creosote is very quiet, and shows no signs of improvement. Heavy and light naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. to 2s. 1d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 5d. naked. Naphthalene,

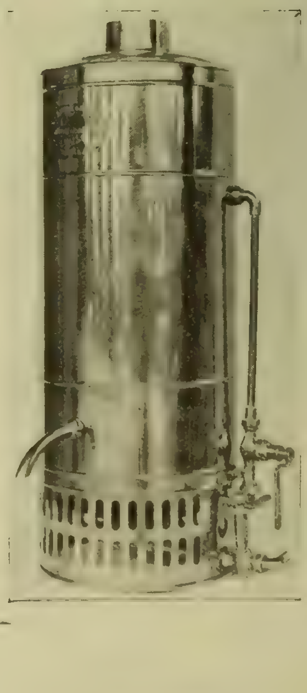
THE "QUICKEST" GEYSER.
SEALED SYSTEM.

Constructed of best rolled copper, tinned inside, sealed from all gas fumes.

Cleaning—disconnect two unions only to remove whole of inner chambers.

Consumption low, combined with high heating efficiency.

Manufacturers—
THE VULCAN STOVE CO.,
Limited,
EXETER.



Telegrams:
"VULCAN, EXETER."

£18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ⅝d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Jan.* 1.

Notwithstanding the intervention of the holidays, the strength of the market has been well sustained during the past week, and a further advance in values has taken place. The volume of foreign business has not been large; but there has been good demand for home consumption for agricultural purposes as well as for munitions. To-day's quotations for prompt delivery are £17 10s. per ton f.o.b. Hull, £17 16s. 3d. f.o.b Liverpool, and £18 f.o.b. Leith. Few transactions have been reported in the forward position this week, but it has transpired that £18 per ton f.o.b. Liverpool has been paid for January-March, and £17 15s. for April-June delivery.

Manchester Tar Prices.

The average price realized for tar—based on the value of the products—for November deliveries, in the Manchester district, was 25s.

Nitrate of Soda.

The market for this material is quiet but steady at 15s. 3d. per cwt. for ordinary quality, and 16s. 3d. for refined, on spot.

Sulphate of Ammonia.

From another source, it is stated that higher prices are still being paid for this article. London makes are reported to have been sold at £17; Hull, £17 10s.; Liverpool, £17 15s. to £17 17s. 6d.; Leith, £17 17s. 6d.; Middlesbrough, £17 15s. to £17 17s. 6d.

COAL TRADE REPORT.

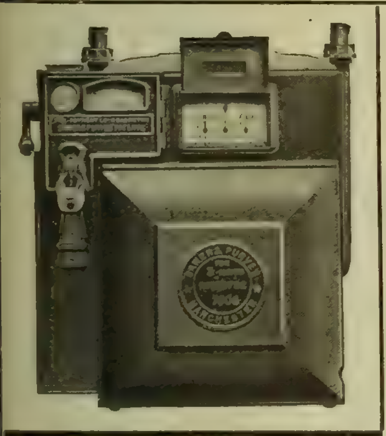
Northern Coal Trade.

The northern coal trade is influenced by the reduced production owing to the holidays, and the fact that this limited output is needed for the current contracts. There is very little steam coal available for prompt shipment, and thus the prices that are quoted are nominal, unless it be for small quantities. For best Northumbrian steams, from 22s. to 24s. is quoted; but probably lower prices will rule as the production grows normal. Second-class steams are about 20s. per ton; and steam smalls vary from 10s. to 13s. per ton—all f.o.b. There are fair arrivals of steamers at the coal ports. As work becomes full at the pits, there should be heavier shipments, and possibly prices more like those that prevailed until just before the holidays. In the gas coal trade, the demand is very heavy; and the long contracts take up most of the production, which is also affected by the slow return to work of the miners. Best Durham gas coals are about 21s. to 21s. 6d. per ton f.o.b. for early delivery; second-class gas coals are 19s. to 19s. 6d. per ton; and "Wear Specials" are 22s. to 22s. 6d. per ton f.o.b. Nothing is doing in contracts just at present. But the fixing of the maximum price for coke for home consumption may have some influence on the coal trade of Durham, which produces coking coal largely, and possibly it may tend to limit the use of coal at some of the ovens. Gas coal must, however, be looked on as beginning to near the time when consumption at home will commence to decrease; but how the stocks generally compare with those usually held at this season is not known with any certainty. Freights are still high—gas coal from the Tyne to London being about 15s. 6d. Coke is influenced by the introduction of maximum prices in some cases; but gas coke is not much altered. Good export gas coke may be quoted at 28s. to 29s. per ton f.o.b. on the Tyne. Stocks of gas coke are not very heavy generally.

Income-Tax on Earnings of All Undertakings.

Mr. H. Ross Clyne, a member of the Manchester Corporation Gas Committee, has tabled the following notice of motion, which he intends to bring forward at to-morrow (Wednesday's) meeting of the City Council: "That, in the opinion of this Council, the Government should forthwith impose a direct income-tax without rebate on the net earnings of all undertakings of whatever nature or constitution—each undertaking to be treated as a separate unit." The question of disposing of a portion of the surplus profits of trading departments of the Corporation is expected to be raised by Mr. James Johnston, who is to move that a Special Committee, of the Chairman of the Gas, Water, Improvements, and Buildings, Sanitary, and other Committees, be appointed, for the purpose of considering the advisability of placing at the disposal of the Local Government Board the surplus land of the Corporation for house-building purposes, and of endeavouring to obtain their assistance in financing a scheme of housing on such land to meet the grave shortage of housing accommodation in Manchester; also to consider the desirability of applying a portion of the surplus profits of the trading departments of the Corporation for housing purposes, instead of borrowing new capital; and to present to the Council a report at as early a date as possible.

Gas-Works Extensions at Devonport.—The Plymouth Corporation Gas Committee have, it is reported, decided to instruct their Consulting Engineer (Mr. Isaac Carr) to prepare plans and specifications for increasing the capacity of the gas plant at the works at Devonport to meet the growing requirements. The Gas Engineer, Mr. W. P. Tervet, reported that the consumption of gas on Christmas Eve was a record one; amounting to 2,106,000 cubic feet, as against 1,980,000 cubic feet in the previous year.



The "Positive"

"THE METER OF MANY MERITS."

SAWER & PURVES,
MILES PLATTING,
MANCHESTER.

BRANCH OF
METERS LTD.
RADFORD ROAD,
NOTTINGHAM.

Agent for Scotland: JNO. D. GIBSON, 2, CAUSEYSIDE STREET, PAISLEY.

Ripon Gas Troubles.

The Ripon Gas Committee have issued a statement in reference to the trouble in maintaining the supply of gas, as already recorded in our pages. They state that the entire plant has been taxed to its utmost, and all reserve generating apparatus has been called into use. Yet, with all resources working at the full, the gas supply to the city has reluctantly been restricted. The labour problem, too, has become most acute; and it has been necessary to call in the assistance of amateur workers in order to keep the city lighted. After full consideration, the Corporation deem it imperative that some immediate steps be taken to augment the existing gas-making plant, in order to secure for the consumers an adequate supply of uniform-quality gas. To attain this end, it is proposed to adopt the most up-to-date methods, embodying every facility for manufacturing high-quality gas on the most economical lines, having due regard to efficiency in every respect. They further hope, by this improved method of production, to reduce the price of gas to the consumer. The statement adds that it is hoped, on account of its urgency and absolute necessity, to obtain the sanction of the Local Government Board to this substantial extension.

Gas Fatality at Blackpool.—A man named Albert Crowther, 70 years of age, died from gas poisoning at Blackpool on Christmas Day. It is supposed that he had occasion to light the gas during the preceding night, and in putting it out accidentally turned the tap on again. At any rate, he was found unconscious in bed, with the unlighted gas turned full on.

Soldiers and Gas Cooking.—It seems that over 10,000 soldiers quartered in Toronto have their meals prepared in kitchens equipped with gas-ranges and gas water-heaters; and daily readings of the meters show that the gas consumed is costing the military authorities less than one-half a cent per day per man. Double oven stoves are used, with four top burners on each oven; and it is found that eight of these double ranges are sufficient to cook for a battalion, consisting of approximately 1200 men. Altogether there are over a hundred of the ranges in use. To supply the camps, it has been necessary for the Toronto Consumers' Gas Company to lay a new main nearly 1500 feet in length.

Second Advance at Stourbridge.—A second advance in the price of gas since the beginning of the war has been agreed to by the Stourbridge Town Council. The Gas Committee recommended that the price of gas for power supply be raised 2d. per 1000 cubic feet, and for lighting purposes 1d., as from the reading of the ordinary meters for the Christmas quarter. Mr. Keeble moved that the recommendation be deleted; but the amendment was not seconded. Alderman Fiddian, in moving the adoption of the report, said the previous advance was 2d. per 1000 cubic feet for power, and 3d. for lighting. It was not proposed to increase the price to slot-meter users. The recommendation was adopted.

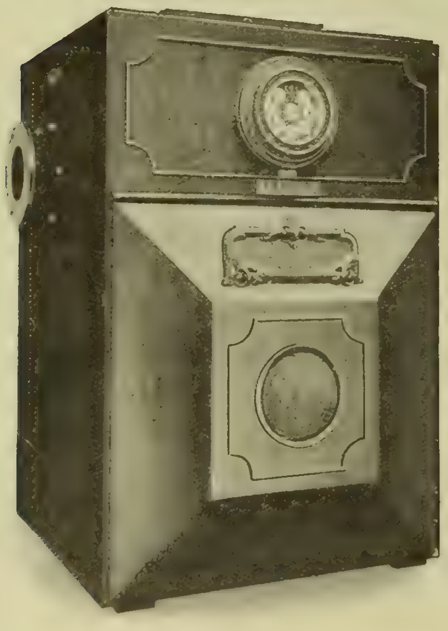
Gas-Mantles in America.

In the course of an article entitled a "New Industry Born of War—Gas-Mantles," the "Chicago Daily News" points out that seventeen months after the outbreak of war, America is still abundantly supplied with incandescent mantles; and the fact marks the birth of the new American thorium industry. It was war that permitted the emergence of the American industrial chemists from under the shadow of the mighty accomplishments of Germany. Under the direction of Americans trained in universities and technical schools, vast sums of money have since July, 1914, been spent in experiment; and amid the varying results, the American manufacture of thorium is a conspicuous example of success. "One case," the writer of the article says, "that is typical of many is that of a Chicago firm, the Lindsay Light Company. For years before the dawn of 1914, this Company's experts had worked out the necessary procedure by means of the laboratory method. That is, the thing had been done on a small scale, with an eye to accomplishment on a greater scale whenever occasion should arise. New machinery had to be provided; and before it could be constructed, it had to be devised. This was done. Within ninety days after they had installed their new plant, the Chicago people were producing. They are now turning out enough thorium nitrate for their own needs, and exporting it to whatever port in the wide world calls for it, and the necessities of wartime commerce permit its entrance. New thorium-bearing sands were discovered far away from Brazil, fresh lanes of ocean traffic were utilized, and Chicago skill was taught to duplicate all the processes that had previously been left to German brains and hands." The Lindsay Light Company (whose agents for the United Kingdom are Messrs. Paul Winn and Co., Limited) say that "every part of every Lindsay gas light and gas mantle is made in the U.S.A."

Increase in Price at Elland.—From the New Year the Elland-cum-Greetland Gas Company have decided to increase the price of gas 4d. per 1000 cubic feet, making it 2s. 10d. During last year a record amount of gas was sold by the Company, owing to the large number of factories working long hours of overtime, and some all night.

More Light for Paris Streets.—In a message dated last Wednesday, the Paris Correspondent of the "Daily Telegraph" said: Paris has never been quite as dark at night as London; and we are now to have yet a little more light. One thousand extra street lamps are to be lit, and in particular there is to be light enough at all street-crossings for safety of traffic. Experts here are sceptical about the usefulness of darkening cities against airship raids. All aviators of the Paris defence force say that, however much the lights of Paris have been put out, they could always distinguish the town without the least difficulty when flying at night. In short, they say that defence against Zeppelins depends solely on the efficiency of the aviation service, and that for Paris to darken herself is a futile ostrich policy. Therefore, General Maunoury, the Military Governor, has decided to allow more light.

BRADDOCK'S IMPROVED GAS METERS



No. 219. Braddock's Large Dry Meter.

SECOND
TO
NONE.

Made
in all
Sizes.

No. 245. Braddock's Large Wet Meter.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), Globe Meter Works, OLDHAM,
Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 815.
AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.
Telegrams: "METRIQUE, LAMB LONDON." Telephone No. 2412 HOP.

Haywards Heath Gas Debentures and Ordinary Stock.—Readers will have noticed in the advertisement pages that Messrs. A. & W. Richards, of No. 37, Walbrook, E.C., are offering for sale by tender £3500 of 5 per cent. perpetual debenture stock and £5000 of ordinary stock in the Haywards Heath District Gas Company. The latter ranks for a standard dividend of 5 per cent., subject to the sliding-scale, and is entitled at the present selling price of gas of 4s. per 1000 cubic feet to dividend at the rate of 6⅛ per cent. per annum. In both cases the minimum price at which tenders will be considered is par.

Nottingham Lighting Restrictions.—Concurrently with the changes which have been made in the lighting administration at Nottingham, some welcome alterations have been effected in regard to street illumination, as to which there had been previously much grumbling, upon the score that the official regulations had been too rigidly interpreted. In place of haphazard daubing, which had the effect of practically obscuring the light, while the gas was burning to waste, the lamps have now for the greater part been cleaned and the glass repainted at the tops and partially at the sides, in a pinkish hue, with the result of preventing diffusion of light above, while rendering it possible for pedestrians to steer their course with a fair amount of comfort in the streets below.

Street-Box Explosions in Belfast.—A defect in the Belfast electric system led to a good deal of commotion a fortnight since. One of the inspection-box covers in Rosemary Street was blown up by an explosion, and immediately afterwards the cover of a second box close at hand was shattered by a like explosion. In both cases the gas-main was injured; and flames leapt through the openings. The gas continued to flare for almost an hour. A water-main was also burst by the force of the explosions; and the thoroughfare was flooded. The electric current was cut off as quickly as possible; and much inconvenience was caused in regard to the lighting.

Carbonizing Plant at Tipton.—The Manager of the Tipton Gas-Works (Mr. William Prince), in a report to the Council, states that the deliveries of gas show a big increase. The first two beds of retorts in the old house were got into working order by Nov. 20, and the gas made in these had enabled him to get through the subsequent large demand made on the works, due to munition requirements, fogs, &c. Though gas was supplied of a lower illuminating power than usual, he was thankful to report that he had at all times been able to meet the demand and maintain adequate pressure on the district. He proposed to submit a report to the Council later on embodying proposals for the further extension of the carbonizing plant.

STOCK MARKET REPORT.

LAST week—the closing week of the year—the Stock Exchange had another four-day period, with a holiday on the Monday and another on Saturday. But it was neither idle nor dull. Business grew in activity from day to day, and the tone, which was very fair at the opening, became brighter and brighter. Thus, on Friday, the week—and the Year of Grace 1915—terminated in conditions of activity and cheerfulness, which it may be hoped are of happy augury for the New Year. Government issues and the gilt-edged group, after some hesitation, went ahead, and War Loan and Consols were in good demand. Americans zig-zagged somewhat, owing to Wall Street operations. They dragged Canadians about with them, notwithstanding the fine show of trade and traffic apparent in the Dominion. However, they finished buoyant. Home Rails were stronger, though one or two questions looming ahead of them are not quite clear yet. In the Foreign Market, French loan and Japanese were prominent. South Africans and Argentine rails showed firmness. In the Miscellaneous group, shipping and armaments were in good demand; but the liveliest line was Rubber, the high price of the raw article causing a rush for shares. So everything went along joyously; and the House took no heed of Cabinet dissensions over supreme affairs of State. A noteworthy incident was a Treasury announcement that, upon the recommendation of the Committee on War Loans for Small Investors, 5 per cent. Exchequer Bonds of £5, £20, and £50 each will be issued, to be obtained (and deposited, if so desired) at a Post Office. At the same time, the limitations on Post Office Savings Bank deposits were relaxed. There was more talk about minimum prices, and rumours of further progress of measures to amend, and perhaps to abolish, them altogether. But as to the policy of this step, opinions differ. Business in the Gas Market was quieter than ever—not sufficient to afford any indication of a tendency to move either way. It must be borne in mind that only one in the entire list of quoted gas issues has an official minimum-price—viz., Melbourne 4½ per cent. bonds. In all the rest, bargain prices are a matter of agreement between the parties. In the Money Market, there was a good demand for the year's end, and discount rates were harder.

Bargains done for cash during the week were as follows: On Tuesday, European $12\frac{11}{16}$, South Metropolitan 79, South Suburban 86. On Wednesday, Gas Light ordinary 71, 71½, 71¾, 72, South Metropolitan 78, 78½. On Thursday, Gas Light ordinary 70¾, 71¼, 71½, ditto maximum 60, Newcastle 80, South Metropolitan 78½. On Friday, European 13, Gas Light ordinary 70½, 71¼, 71½, preference 75½, Imperial Continental 80, 82, Primitiva debenture 85, 85½, South Suburban preference 90.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

At a parish meeting at Pilsley, it has been unanimously decided to discontinue the public lighting for the remainder of the season as a protest against the increase of 3d. per 1000 cubic feet demanded by the Clay Cross Gas Company. It was also suggested that the gas-lamps be taken down and stored; and Mr. W. F. Clayton expressed the hope that the residents of Pilsley would not capitulate, "even if they never had the streets lit again."

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
873,480	10	,,	7	7/-	B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
830,000	,,	,,	†11	55/-	Do. New	204—209	5 5 3	..
50,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	,,	,,	5⅓	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	$12\frac{11}{16}$–13
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	70½–72
2,600,000	,,	,,	3½	3½	3½ p.c. max.	76—79	4 8 7	60
4,062,235	,,	,,	4	4	4 p.c. Con. Pref.	96—99	4 0 10	75½
4,674,850	,,	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	,,	,,	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅝	7¾	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	6¼	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	80—82
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	,,	,,	7		B	146—148	4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	80
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—84	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 13 4	..
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4¾—5	5 0 0	..
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	85–85½
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	78—79
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	86
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	90
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	135—138	5 8 8	..
742,275	,,	,,	6	6	B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	
255,636	,,	,,	6⅞	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/3	55/1½	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

The Guiseley District Council have decided to try automatic street lighting apparatus to the extent of purchasing 80 "Gunfire" automatic street lighting controllers.

The Twickenham Lighting Committee consider it undesirable that the testing of the gas for calorific power should be discontinued, and have given instructions for the results of such tests to be reported for Committee purposes only.

The 1st of January was the 17th anniversary of the taking over by the Morley Corporation of the gas-works of the Morley and Churwell Gas Companies, at a total cost of £128,000. During the past year, nearly £10,000 has been spent in remodelling the plant, particularly in the installation of the vertical retort system.

In the course of the discussion in the French Chamber on a Bill relating to the sale and distribution of coal, M. Roden (President of the Mines Committee) pointed out that two milliards of francs annually went from France to England, and appealed to English shippers to reduce the cost of freight. He advocated still closer relations with those on this side who understood and facilitated coal transactions.

According to the "South Wales Daily News," in arranging new coal contracts with local authorities, some contractors are inserting a clause which will enable them to terminate the contracts at a week's notice if they find it impossible to deliver the coal because of further enlistments of their men.

At an inquest held at Greenwich on the body of James Cardoe, a driver in the Army Service Corps, it was stated that during the gale on Monday night of last week, some electric wires used for lighting the huts at Blackheath blew down. Deceased appeared to have fallen among the wires, with the result that he was electrocuted. A verdict of "Accidental death" was returned.

We have received from Messrs. W. G. Beaumont and Son, the painting contractors, of Priory Works, Bow, E., a copy of their Year Book and Diary for 1916. On the gas manager's desk, this book will prove a useful reminder, in more ways than one. There has also come to hand a dainty pocket diary from the Torbay Paint Company; and a date-stand from Mr. A. C. Scrivener, the Birmingham representative of the Wigan Coal and Iron Company.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Gas and Water Engineer. Mansfield Corporation. Applications by Jan. 18.
Outdoor Superintendent. Cheltenham Gas Company. Applications by Jan. 15.
Clerk. No. 6132.
General Working Foreman. Ascot Gas and Electricity Company.
Mechanic. Stretford Gas-Works.
Works Mechanic. No. 6130.
Yardman. King's Lynn Gas-Works.
Stoker. King's Lynn Gas-Works.

Plant, &c. (Second Hand), for Sale.

Cookers. No. 6131.
Retort Bench Fittings. Ilford Gas Company.

Plant, &c. (Second Hand), Wanted.

Purifiers. No. 6129.

Patent Licence.

Incandescent Mantle Manufacture. Haseltine, Lake, and Co., 28, Southampton Buildings, Chancery Lane, W.C.

Sales of Stocks and Shares.

Haywards Heath Gas Company. By tender. Jan. 14.

TENDERS FOR

Tar.

Harwich Gas Company. Tenders by Jan. 8.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1916 are reminded that this can only be done before the end of January.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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JOURNAL OF GAS LIGHTING & WATER SUPPLY.

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VOL. CXXXIII., No. 2748.] TUESDAY, JANUARY 11, 1916. [68TH YEAR.

EDITORIAL NOTES.

The New Gas Finance.

EARLY in the days of the war, attention was called in the editorial columns of the "JOURNAL" to the question of the necessity for easing the conditions under which gas capital was raised, in view of the prospects of a protracted colossal struggle, huge expenditures, the attractions that would be held out to secure the necessary funds for carrying on the immense conflict, and, finally, when release came from the veto of the Treasury, the competition on inviting terms that there would be for new capital for industrial and trading purposes, and to repair the material mischief of gigantic proportions occasioned by the war. Developments so far have proved the accuracy of the forecast, as was shown by further articles subsequent to the issue of the new 4½ per cent. War Loan, with Government security, and redeemable at par. Since then have come the alluring 5 per cent. Treasury Bonds, which are now being issued to unlimited amount. All this has considerably altered the financial situation, and the standards on which capital can be raised for the soundest of established enterprises. But before hostilities commenced, there was a marked tendency in the direction of higher returns on investments being necessary, and undertakings of all kinds needing capital had to submit to this tendency. Those gas concerns that were under certain conditions which were considered quite good and effective a dozen years or so ago, began to find themselves severely handicapped, in regard to low interest-bearing debenture and preference stocks, and ordinary stocks as well, unless under the sliding-scale good dividends were being declared. Investors absolutely refused to look, for instance, at 3 and 3½ per cent. debenture stocks or 4 per cent. preference stock in trading companies. Gas undertakings are therefore finding it necessary to secure greater liberties by obtaining relief from effete and inapplicable conditions, and to be in a position to offer much better terms, which will obtain favour in the eyes of investors, and so stand a chance in the competition for capital.

We see a very decided movement in this direction in the Bills that have been lodged for the consideration of Parliament in the coming session. In the preamble of the South Metropolitan Gas Company's Bill, it is submitted that, in the circumstances which prevail at the present time, the Company are unable to dispose of their ordinary stock otherwise than at a price less than the nominal amount, and therefore, as well as in certain other respects, the conditions governing the issue of the ordinary stock of the Company are inconvenient and obsolete. Then we have the Newcastle-upon-Tyne and Gateshead Gas Company saying, in the preamble of the Bill they are promoting, that, having regard to the present state of public affairs, it would be to the advantage of the Company and the consumers of gas, and would facilitate the raising by the Company on economical terms of the money required for the purposes of the undertaking, if the Company had larger powers in relation to the creation and issue of debenture stock. Here we have two large and important gas undertakings, widely separated, both with excellent records, both held in high esteem among investors, making the same admission, that the capital-raising position is not now as it used to be, though the two concerns show expansion, and a broader foundation, and a financial condition stronger than ever. Their admissions are significant, and their conditions in this matter are typical. Times have changed in regard to capital provision; and the cast-iron regulations of the past must be modified. Under their existing statutes, neither of these concerns is able to issue stock by auction or tender at a reserve price less than the nominal amount. In certain conditions of the Money Market, or when adverse trading circumstances reign, and dividends are consequently depreciated, this stipulation is an obstacle to the securing of fresh capital. It was found so by several companies long before the war; and it will be found even more so under the new circumstances created by current events. Therefore, the two Companies are asking to be released from the prohibition, and to be allowed such freedom in fixing a reserve price as may be considered by the Directors fit and proper under the conditions ruling at the time the money is required. Circumstances nowadays change with remarkable rapidity. New factors have come into play which did not affect the steady old-fashioned days, and these factors are all too likely to become with time more intense in their operation.

Better terms have also now to be offered to get people to invest in preferential stocks. High rates of dividend on preference stocks and shares are to-day being offered by well-founded business establishments; and they will have to offer still higher rates in the competitive future. Gas undertakings have long since felt that, where their power in regard to offering preferential dividends was narrowly limited, they stood in the competition for capital a poor chance in obtaining the cheapest possible money by the issue of loan and preferential securities. Here we have the Newcastle Company now asking that, as from the passing of the present Bill, 7 per cent. shall have been deemed to have been inserted in section 15 of their Act of 1901, instead of 4 per cent. in connection with the issue of new preference capital—a raising of the limit by 3 per cent. in fifteen years! What suited 1901 will not suit 1916. The Colchester Gas Company also ask for the right to pay a dividend on their preference stock not exceeding 7 per cent. The Ferndale and Folkestone Companies will be satisfied with "not exceeding 6 per cent.;" while the Fleetwood Company, who as recently as 1912 thought that not exceeding 4 per cent. would suffice for their borrowed money, are now asking for the limit to be raised to 5½ per cent. The Newcastle-upon-Tyne Company want the power to offer 5 per cent. for debenture stock; and the Uxbridge Company are asking for the limit of interest on borrowed money, as inserted in their Order of 1914, to be repealed. Again there is an incipient change in regard to the proportion of borrowing powers to ordinary capital. At one time the borrowing-powers proportion was one-fourth of the total issued and paid-up capital; and then it was raised to one-third. Now companies are leaning to the opinion that it would be an economic procedure to make still larger use of their credit. In the Ascot Act of last year the proportion of borrowing powers was raised to one-half; and now the Newcastle and the Aberdare and Aberaman Companies are also asking for the one-half. But a very favourite movement is the request for powers to issue redeemable debenture and preference stocks. Such desire is noted in the Bills of the South Metropolitan Company, the Imperial Continental Gas Association, the Newcastle-upon-Tyne Company, the Plymouth and Stonehouse Company, the Colchester Company, and the Aberdare and Aberaman Company. All the Bills, of course, provide for the formation of redemption funds.

There are indications here provided by substantial companies that the old terms under which private gas enterprise has been financed in the past are undergoing very definite modification. The terms of the past are out of joint with modern conditions; and, when this is the case, there is only one thing to do, and that is to bring about a correlation between the terms and the conditions.

Co-Operation in Developing Industrial Heating.

IT is generally admitted that, in districts where manufacturing work abounds, the use of gas for industrial heating is going to be a most important branch of the business of gas undertakings; and yet it is a curious reflection that up to now the most spirited work in the development of the utilization of gas-furnaces and so on has been done not by the suppliers of the fuel for such appliances, but by the manufacturers of the latter. This is to their credit, and undoubted profit. And it is to the profit of the gas-supply industry; but its credit in the matter only extends to the amount of help that has in isolated cases been given to the manufacturers. In some districts this help has been good; in others it has been of quite a passive order. But in all gas-supply areas, the active order of assistance is needed. "The measure of opportunity is the measure of responsibility," said Mr. H. M. Thornton (in another connection) in a lecture he delivered last evening before the Derby Society of Engineers. And in this matter of developing the industrial uses of gas, the measure of every gas engineer's opportunity is the measure of his responsibility; and it is his responsibility to work to the utmost of his opportunity to show the local manufacturers that gas-heating is an important factor in industrial economics. There could be no better time for doing so than the present, when gas heating for the production of war material of all kinds—from shells and machine-guns to small arms, ammunition, and much else—has been so largely adopted and readily applied, and when gas furnaces and crucibles of all types and sizes have been turned out and installed at a rate that has produced a new flood-mark for such work.

What, however, is wanted is a greater amalgamation of brains, and greater co-operative effort, in the work of development. During the war, we have heard a great deal regarding the organization of our national resources—the scientific and the industrial among them. In the gas industry, we have a sample of the organization of part of its resources in the British Commercial Gas Association; but it does not constitute a complete utilization co-operatively of the industry's potentialities. Here we have the manufacturers of gas-furnaces doing their part unaided, except (as already said) in a few cases, in converting manufacturers from crude to scientific heating processes. True, no one is better qualified for doing this, for the development of every detail of the furnaces, and the adaptation of them to all classes of work, have given the manufacturers an unrivalled technical education and experience in the matter, and thus a specialization that cannot be claimed by the suppliers of gas. But the measure of their opportunity is respectively a diverse quantity. Of the accumulated knowledge and experience, the utmost should be made by the gas suppliers through co-operation; and those responsible for the conduct of gas undertakings are in the position to provide the opportunities for making the largest use of it. The lecture delivered last night by Mr. Thornton before the Derby Society of Engineers is a case in point. Mr. J. Ferguson Bell, M.Inst.C.E., the Engineer and Manager of the Derby Gas Company, is this session the Chairman of the Society. What better opportunity could there be for bringing before the engineers engaged in other industries in Derby and the neighbourhood information regarding the vast part that gas is now taking in the nation's work, through the excellent appliances that have been developed in which the thermal value of gas is utilized, and in which, through the regulation of temperatures and conditions, time and working economies are realized? The opportunity was there, and a good platform was available; and we undertake to say that the Derby Society of Engineers have never had before them a lecture, with full and abundant illustration, that was at once more instructive and more to the taste both in the form of subject-matter, and in the manner of treatment. We do not say that, in this, Mr. Thornton excelled what is possible from other manufacturers—indeed, upon the merit of his platform work, in comparison with that of others, it would be invidious for us to pass judgment. With him, as with other manufacturers, it is their business to supply gas-furnaces and to profit thereby; but it is his and their knowledge of the making of gas-furnaces and of the application of them to all sorts and conditions of work that is of value to the gas-supply industry in developing gas-heating in the country's manufactories. And this the lecture last evening (the greater part of which we print in other columns), as have other lectures, shows can be utilized in an informative way without any vulgarizing of the standard of technical association work by constituting the platform provided into a medium for the advertising of an individual firm's wares.

There is an example of co-operative work in the development of the gas industry. It is a co-operation of brains. Among the manufacturers we have some of the finest technicians—specialists in their own departments—in the industry. They want bringing out, more than their own commercial travellers, in the cause of a general industrial expansion. If gas engineers—themselves manufacturers and traders—will stand aloof, and if they will decline to recognize that the spirit of co-operation is abroad, that the organization of talent and resources is to-day one of the primary features of progressive means, then the blame must entirely rest upon their old-fashioned conservatism, exclusiveness, and narrow-mindedness that they are not making the best use, through a common interest, of available opportunities. The manufacturers of gas appliances of all kinds have a large interest in seeing the development of gas supply, just as have the producers of the gas itself. It is through this development that increasing prosperity and stability are brought to the gas-supply industry, and the same to the firms engaged in ministering to the requirements which are the channels of development. If the gas suppliers co-operate in providing opportunities and influential audiences for lectures such as that delivered last evening, and of other order in respect of subject, they will find willing response to the "filling of the bill" by those with the necessary capacity and information at disposal. But these are busy men, and they have their immediate business affairs requiring fairly constant attention. It must not, therefore, be expected that they can spend hours in travelling, and time and money in lecturing to a local debating society. We have used the expression "influential audiences," which conveys to any intelligent mind exactly what is meant, and what is needed. The Derby Society of Engineers supplied an "influential audience" in relation to the theme of industrial gas heating; a meeting of the members of the medical and architectural professions would constitute an "influential audience" in relation to domestic heating. These are sufficient illustrations. Development from old to new ways needs educational spade work; and impressions left upon the minds of influential audiences are the seeds which germinate, grow, flourish, and are reproductive. There is no limit to the good effect of a well-made impression upon the mind.

To the subject-matter of Mr. Thornton's lecture (which was largely pictured by lantern slides), we will only make passing reference. It was illustrative of many things—of the progress that has been made in gas-furnace construction, in which (the lecturer did not say this, but we may) the Richmond Gas Stove and Meter Company have taken good part; of the manifold applications of gas in the heat treatment of metals; of the need for discrimination in the matter of types of furnaces for particular work; and (this section will be read with especial interest) of the special utilization of such furnaces in the production of war essentials which has changed the whole aspects, operations, and engagements in our engineering and metallurgical industries. It may be said, too, that the war has enlarged the experiences of the manufacturers of gas-furnaces; and this means an expansion of competence in the matter of production and application. Much else was in the composition of the lecture and in the illustrations; and it will all repay perusal. In respect of policy, the occasion has enabled us to make the plea for a greater co-operation in the work of development in the somewhat difficult branch of industrial heating—difficult through long custom and usage, but promising more than ever through the experiences that the war has compelled and has produced.

Gas-Works Experiences in Australia.

Hearty welcome is given to the New South Wales and Queensland Gas Institute—the newest addition to the roll of professional co-operative organizations in the gas industry. The first annual meeting of the Institute has been held under the presidency of Mr. T. O. Morland, the Manager of the North Shore (Sydney) Gas Company; and the proceedings, as indicated by the address and papers published in this issue, give promise of a healthy career which should be, and must be, of immense service in the technical and commercial development of the industry in the two Colonies. Intercourse of persons concerned in any particular sphere of technical or commercial work is always advantageous; and it is particularly so where, through geographical situation and long distances, there is very little opportunity for coming together for the exchange of experiences and information. The new Institute is the second organization for gas engineers and managers in ustralia; its predecessor being the Victoria Association, f which we have heard little news for a long time now. 'his silence cannot be due to exhaustion, seeing that 'ictoria, like New South Wales and Queensland, has been njoying very good expansion of business, and has had pportunities therethrough for making works' extensions nd producing modernization of plant. When this is the rend of things, there is always topic to bring before meet- igs of gas managers.

In New South Wales and Queensland, the works number nly 61, so that there is not much chance of the member- ip of the Institute swelling to unmanageable proportions. ist as Victoria has a predominating gas undertaking in [elbourne, so New South Wales has the same in the ustralian Gaslight Company of Sydney. Nevertheless, e progress in gas consumption during the septennial eriod ending in 1914 seems to have been quite general the two Colonies embraced by the new Institute—the crease having been 68·5 per cent. in New South Wales, nd 100·3 per cent. in Queensland. But progress of the is undertakings in them has been not only of the com- ercial order, but of the technical. The two Colonies are ot a whit behind the most advanced part of the world's s industry in modern types of gas-engineering struc- re and plant. The Australian Gas Company entered into contract (we should say) upwards of two years ago for a sholder ranking equal in capacity to the largest we have London—viz., 12 million cubic feet. From the Presi- nt's Address, and from the papers read at the meeting (as produced elsewhere), it is seen that vertical retorts, modern oking machines, material handling plant, and high-pressure s distribution, are adoptions and recognized practices; d advances will continue to be made in their application. ost undertakings in these Colonies are increasing commer- lly; and, when this is the case, the opportunities occur d accrue for enlisting the service of the most approved rms of plant and methods. This is being done.

There are two specially interesting points in the Presi- nt's Address, which may be noticed. At one of the North ore Company's works, the natural formation of the ound has been brought to bear in facilitating operations the works. An inclined retort-house is erected at the ot of a cliff, on the top of which—50 feet above ground- or level—a coal-store has been erected for feeding the lined retort-house, which is done by subways and shoots nning from the coal-store floor, which shoots deliver into cks, and the trucks into the charging-hoppers. By the of the shoots, coal can be drawn daily from all parts of store, and the temperature of the mass be ascertained. e second point is as to the excellent experience with ersible condensers in reducing naphthalene deposits, and refore complaints. This experience is a direct outcome the paper that Mr. Charles Carpenter read in London ore the Southern Association in 1901; and this shows v the benefits of the communication of experiences at neeting of gas engineers and managers are not limited to se present at the meeting itself, but that the publication the information carries derivable advantage to the utter- st parts of the earth—the Technical Press forming the nnel of communication between the meeting and practi- ly every gas engineer and manager in the world.

Excellent experience was recounted by Mr. J. Mackenzie, Newcastle (N.S.W.), with the Glover-West continuous tical retorts, which he has had in use for some two and- alf years; and the experience shows that, as it has done South Africa and elsewhere, that vertical retort working swers admirably with the local coals. Of course, one not say that the continuous system is the best for all sses of coal, especially such types as are not of good ing property. Mr. Philip Holmes Hunt made out a d case some years ago—in 1911 and since—in this con- tion when he determined on the adoption of the inter- tent system for Melbourne. But what Mr. Mackenzie suffered from has been an excessive swelling of coal in retorts, or an irregular internal growth of carbon, which caused "hanging-up" of the charges. But by mixing classes of coal, he has overcome this trouble, and the rking is entirely satisfactory. He, however, questions validity of the term "continuous" as applied to these orts, as he finds that, as the extractor removes a quantity the spent charge, and fresh coal enters the retort, there rush of gas; and these intermittent rushes seem to mind to affect the idea of continuity. This is a small nt; but we cannot altogether agree with Mr. Mackenzie with regard to it. The intermittent rush, temporary but not really large, there undoubtedly is. It was a common experience in the days of the old Settle-Padfield retort that as the fresh coal fell into the carbonizing zone, so a large volume of gas was at once evolved; but with the continuous retorts this is minimized. At any time, there are the same temperature and production continuity proceeding at each stage from inlet to outlet of the retort; and this maintains such a uniformity in gas composition that we have those excellent straight-line calorific value charts, such as Mr. J. G. Newbigging has more than once presented to the gas profession. While Mr. Mackenzie has nothing but good to say of the continuously working retorts from the economic aspect, he does point out that the coke is harder and contains less volatile matter than coke from horizontal working, and that the tar is thinner and contains more light oils. What are advantages in this country thus appear to be disadvantages in Australia. Here a hard coke realizes more money for metallurgical, greenhouse, forge purposes, &c.; but Mr. Mackenzie's market seems almost exclusively the domestic one. Here a tar containing an increased quantity of light oils appreciates in value. Evidently Australia hitherto—it cannot be so now—has not had a large market for light oils, seeing that the author of the paper appears to make it almost a point for complaint that, before the vertical retort tar is suitable for road-making purposes, it has to be denuded of its water and light oils. All the better for the roads, even in comparison with crude tar from horizontal working. Tar is in very good demand in Australia for road purposes; its use being recognized there as an economy through the improvement in the cost of road maintenance. The heat so dries the roads that the surfaces of macadamized ones get broken up by the traffic; and it has been found that nothing keeps them in such good condition as a few coats of hot coal tar. When these have been applied, it is the experience that the hotter the weather the more elastic the road becomes.

Of no less interest is the paper by Mr. T. F. Waugh, on "High-Pressure Distribution." From this it is seen that the Australian Gas Company have gone in for high-pressure work extensively for increasing and maintaining the supply of gas in the suburbs. At the present time, they have no less than 160 miles of high-pressure gas-mains, with ninety district governors working off them. The system is found to be financially economical, and an unqualified success in operation—the consumers in the most remote quarters now obtaining an unvarying supply, irrespective of demand. There is one point Mr. Waugh especially emphasizes, and it is that money spent on testing high-pressure mains is money well spent.

We congratulate the new Institute on the character of their inaugural proceedings, and wish the organization a continuously cumulative success.

Coal Figures.

Information regarding a number of matters of interest in connection with the much-discussed subject of coal is to be found in Part III. of the Home Office Annual Report on Mines and Quarries for 1914, figures extracted from which, along with some taken from previous issues of the Blue-Book, are reproduced on another page of this issue. Furnished on much the same lines (though in a very abbreviated—war economy—form) as hitherto, the statistics offer ample scope for comparison with other recent years. In the first place, it will be noted that the record output of coal in the United Kingdom that was experienced in 1913 was not beaten in 1914, which, on the contrary, shows a falling off of 21¾ million tons, with a total of 265½ million tons. At the same time, the value was less by practically £13,000,000. As a matter of fact, the total value of the minerals raised during 1914 in the United Kingdom amounted to £145,863,032, of which coal accounted for £132,596,853; the decrease being £14,249,635, as compared with 1913. Along with the falling off in the output of coal, there is witnessed a slight decrease—something less than 2d. per ton—in the average price realized at the pit's mouth; the figure being 9s. 11·79d., as compared with 10s. 1·52d. for the year before. Though the general figures for 1914 and 1913 are of more general concern, few persons who study this Blue-Book will be able to pass over, without some reflections on their magnitude, the total figures quoted, as indicating the wealth which the country is deriving from its mineral resources. During the forty-two years from 1873 to 1914, we are told, the value of the minerals raised amounts to £3,664,980,074; and of this sum coal accounts for £3,083,191,238, or 84·1 per cent. In that period, 8,206,243,000 tons of coal have been raised, of which amount 2,012,796,000 tons, or more than 24½ per cent. of the total production, have been shipped abroad as exports, in the form of coal, coke, and manufactured fuel, and as coal used in steamers engaged in foreign trade. The percentage of coal so shipped abroad rose steadily from time to time, until in 1913 it amounted to 34·2 per cent., as compared with 13·8 per cent. in each of the five years from 1873 to 1877. For 1914, however, there is exhibited a decline to 30·5 per cent.

An Engineering Correspondent and Train Lighting.

The writer of "Engineering Notes" in the "Daily Telegraph" has been stating his views in condemnation of gas lighting on trains and in favour of electricity. We do not know what this gentleman's qualifications are for passing judgment; but he appears to have based it on the assumptions which have been found in the reports of Board of Trade Inspectors, without any definite evidence to support them, and with the conditions all against them regarding what happens on gas escaping at high pressure from fractured gas-cylinders. It is very evident that the writer of "Engineering Notes" in the "Daily Telegraph" knows of the subject just about as much as—perhaps less than—the Board of Trade Inspectors, on whose reports he depends, and with which reports he seems to have a very poor acquaintance. He says that the recent Tyneside disaster furnishes another tragic reminder of the danger of using gas for the purposes of lighting railway carriages. We should like him to point to something definite in the evidence in support of this statement. There were certain people who "thought" the flames they saw were caused by gas. But when technical evidence is given as to cylinders being fractured and burst, and connections wrenched off them, it would be interesting if this engineering correspondent would tell us how, under such conditions, high-pressure gas let loose, would hang about the railway carriages for the purpose of contributing to the conflagration. "Unfortunately," he also says, "we have had accident after accident in recent years on our railways where the wreckage has been fired . . . by escaping gas." Where is definite evidence of this? He also wants members of Parliament to insist on Government action; "otherwise we shall assuredly have many repetitions of the horror of Jarrow and Aisgill—to mention but two names in a long and ghastly list." This is proof positive that the writer does not know anything very exact about the matter of which he is writing.

From the Inspectors' Reports.

We look back. Major Pringle, in his report on the Hawes Junction disaster said: "This is actually the first occasion when it can be proved beyond question or doubt that fire was occasioned by burning gas. It has to be remembered also that gas has been in use for lighting purposes for a very long period, and that during the whole of that time—in fact, since the year 1868—there is no case of fire destroying either the lives or bodies of passengers in railway accidents." In his report on the Ditton Junction disaster, Lieut.-Col. Yorke said, in fairness to the London and North-Western Railway Company, that gas had been in use upon their trains for thirty years, during which period 2937 million passengers had been carried; and this was the first occasion on which it had been suggested that gas had been concerned in burning one of the Company's trains. However, in this Ditton accident, the Inspector assumed that, though the pipes and connections were all broken off the cylinders, and gas at high pressure was thus liberated to the open air, gas had something to do with promoting the conflagration. As we showed in an article in the "Journal" for Dec. 31, 1912, there was never a case presented in which pure conjecture predominated more than in the Ditton one as to the part that gas had taken. In the case of the Aisgill accident (on which the "Engineering Correspondent" so much relies) Major Pringle pointed out that the gas must have promptly escaped, in view of the condition in which the cylinders were found; and he concluded that the more serious outbreak of fire arose not so much from the ignition of gas (which he only thought caused the first visible appearance of fire), but from the contents of the ash-pan and the heat radiated from the engine. Then, again, in the Carlisle accident, Lieut.-Col. Druitt stated that he considered the cause of the outbreak in the main part of the wreckage was due to live coals from the overturned engines of the troop train, though he was of opinion that the fire was afterwards intensified by the escape of gas from the cylinders as they burst. It is more likely that the cylinders did not burst at all, but that they were broken, and had their connections severed immediately in the accident, under which conditions there would be no after-bursts. Lieut.-Col. Druitt added that he considered a fire would have occurred even if all the vehicles had been electrically lighted. In view of these statements, in view of the obvious conditions that must obtain with fractured cylinders or severed connections, it would be interesting to have from "Engineering Correspondent" a technical explanation as to his attitude.

The Waggon Pooling Question.

The legal position in relation to privately owned railway waggons has been stated in an interesting article that has appeared in the "Iron and Coal Trades Review," and, in our "Miscellaneous News," we have, under acknowledgment, reproduced the greater part of the article. In another article, our contemporary, by the process of deduction, seems to have arrived at the conclusion that there is a good chance of the last having been heard of the pooling arrangement, so far as private trucks are concerned. The project, it says, has either been abandoned altogether, or postponed for further consideration at a more convenient time. The "further consideration" was promised directly the storm of protest came about the Board of Trade; but, as to the abandonment, we do not think the ground of inference adopted by our contemporary is a sufficient one. It says: "It seems all the more probable that no attempt is to be made to interfere with the private rolling stock, because there was no reference at all to the matter when questions relating to the supply of waggons were asked in the House of Commons just before Christmas." If there is not anything stronger than this to go upon, then there is not much there to support the idea of abandonment. We think a much more hopeful sign is that the remonstrances of the private owners had such immediate effect in persuading the Board of Trade that there was another side to the scheme that in justice demanded consideration. The postponement, and the fact that nothing more has yet been heard of the matter from official quarters, suggest that the difficulties surrounding the proposal are found sufficiently serious to justify the matter being entirely dropped. However, the "Review" states that it is thought some pooling scheme will be applied to all railway owned trucks.

Coming Patent Changes.

A change is coming about in connection with the numbering of patent specifications, which is intended to have for at any rate one of its main objects the earlier publication of abridgments of specifications in the "Official Journal" of the Patent Office, so as to facilitate search. The intimation which is being made by the Comptroller-General (Mr. W. Temple Franks) is to the effect that, in order to give the public the advantage of having abridgments of specifications up to date, while retaining their numerical sequence, applications for patents made after the end of last year will be given new numbers when their complete specifications are accepted, or become open to public inspection before acceptance. In connection with the new numbers, there will be no mention of a date; and, doubtless in order to avoid any possibility of confusion, a start will be made at No. 100,001. This new number will supersede the original application number in all respects after the acceptance of the complete specification. Up to this time, the original application number should be used for correspondence and similar purposes; but in all proceedings after acceptance the new number only should be employed. For the future, too, reference to the "Official Journal" will be simplified by the fact that applications will be arranged alphabetically under the names of the applicants and communicators, instead of numerically as at present. The application number will be followed by the date on which the application was filed. The date, however, which the patent will bear, if granted, will appear in a subsequent list of complete specifications accepted. As the result of the new arrangements, it is intended to publish abridgments of specifications in the "Official Journal" a few weeks later than the number in which their acceptance or publication is advertised, so that they will be available for search purposes soon after the printed copies of the specifications are on sale; but until the system is fully in force, they will only be issued when there are sufficient to ake up a full sheet of sixteen pages. Until April of next year, e present series of abridgments in the "Official Journal" will n concurrently with the new series; but as from that time, it ill be entirely superseded.

oard of Trade Arbitration.

The present policy of appealing to the Board of Trade for arbitrator in connection with industrial disputes [of which in- ances are from time to time to be found in the pages of the JOURNAL," as elsewhere], is not regarded with favour by the xecutive Committee of the Employers' Parliamentary Associa- on, who express the opinion that it is wrong. There is no oubt, in many instances, a great deal of truth in the argument hich is put forward by them in the annual report of the Associa- on, that the cause of industrial unrest is largely ignorance—on ie part of the workers as to the difficulties of employers, and the part of employers as to the conditions under which the orkers live. Taking this as their standpoint, it follows that the ommittee prescribe the principle of joint conference as the most acticable remedy; so that, by educating one another, both sides an see matters in a right perspective. There is cited as strongly idorsing this view the freedom from disturbance which charac- erizes industries where both employers and employed, efficiently rganized, can confer frequently. Can there be, one wonders, any etter method than co-partnership for securing the close relation- ip which is here implied? So far from this desirable condition affairs being promoted by Board of Trade arbitrations, the ommittee say the result is that each side views the other with ntagonism, and the cleavage of interests becomes even more ronounced. There is, however, another aspect of these arbitra- ons to which attention is drawn in the report—the Committee re, of course, dealing with the Board of Trade industrial arbitra- ons, and not with proceedings of any other kind. It is claimed y them that a study of the results of labour disputes would indi- ate that the arbitrator, in a very large proportion of cases, simply divides the demand for an increase in wages by two." hat is to say, if a demand is put forward for an increase of 6d. er hour, both sides in many instances are aware that an increase f 3d. will be granted. It is to be hoped that the Committee are istaken in their conclusion as to the manner in which these ecisions are, "in a very large proportion of cases," arrived at; r it cannot be denied that, as they say, to reduce a question f national importance to the level of a division sum is playing ith the problem, and tends to increase the difficulty. They ould, if they had their way, discourage parliamentary or depart- ental interference with the relationship between capital and bour; and they declare themselves in strong opposition to the olicy of compulsory arbitration.

PERSONAL.

The North Berwick Town Council have appointed Mr. R. J. HILP as Manager of their gas-works, to succeed Mr. R. B. Chal- ners, who, after 2½ years' service, is leaving to take up a posi- ion with Messrs. R. & A. Main. Mr. Philp is at present Gas Ianager at Polmont.

The duties of Manager and Secretary of the Cirencester Gas Company, Limited, which were previously combined, have now een separated. Mr. E. M. BEECHAM retains the managership; Ir. E. J. WALLIS has been appointed Secretary, after having cted as Assistant Secretary for close upon four years.

The position of Engineer to the Gosport Gas Company has been illed by the appointment of Mr. EDWIN ALLISON, Assistant Engi- eer at Redhill. He served articles to Mr. J. C. Belton, at Chester, nd afterwards joined the drawing office staff of Messrs. George Waller and Son, of Stroud. In 1910, Mr. Allison obtained a posi- ion on the managerial staff of the Londonderry Gas Company, which he vacated in 1911, upon being appointed Assistant Man- ger at Airdrie. He was appointed to Redhill two years ago.

Professor Meldola, who died on Oct. 16, left property of the value of £34,956; the net personalty being £33,767.

The "Beal Medal" has been awarded by the Committee of he American Gas Institute to Mr. Frank W. Steere, of Detroit, Mich., for his paper on "An Electrical Process for Detarring Gas"—regarded by them as the best paper presented at the annual meeting of 1914.

Gratification has been occasioned at Ilkeston by the fact that he Mayor (Mr. J. A. Macdonald), who has accomplished excellent work as Chairman of the Corporation Gas Committee, has been selected, upon the nomination of the Lord Lieutenant (the Duke of Devonshire, K.G.), as a Magistrate of Derbyshire.

GAS BILLS FOR 1916.

[SECOND ARTICLE.]

CONTINUING our review of the Gas Bills which have been lodged for the consideration of Parliament in the coming session,

The next measure to be noted is that of the Folkestone Gas and Coke Company. The preamble recites among other things, that the present capital consists of £45,000 of 10 per cent. shares (including converted loan capital raised under the Act of 1865, £60,000 of 7 per cent. shares, £15,000 of 5 per cent. shares (being converted loan capital raised under the Act of 1876), and £50,000 of 7 per cent. shares. The Company are proposing to absorb the Hythe and Sandgate Gas Company, whose capital consists of £6660 in ordinary shares, entitled to a standard dividend of 10 per cent. per annum, £12,900 in ordinary shares entitled to a standard dividend of 7 per cent. per annum, £1060 of 4 per cent. preference shares, £3380 of 5 per cent. preference shares, and £10,140 of 6 per cent. preference shares, leaving additional capital to the amount of £4860 authorized to be raised under the Hythe Order of 1911. The Hythe Company have also raised on loan the sum of £8800 by the issue of £8800 of 5 per cent. debenture stock, leaving a further sum of £2200 to be raised under the Order of 1911. Between the two Companies, considerable confusion, it is stated, has arisen as to their respective limits of supply in Cheriton and Sandgate in which the distribution mains overlap. The Folkestone Company have for some time past supplied part of Cheriton which is within the limits of supply of the Hythe Company; and the Hythe Company have also for some time past supplied part of the borough of Folkestone which is within the limits of supply of the Folkestone Company, and beyond the limits of the Hythe Company. An action is now pending by the Hythe Company against the Folkestone Company in connection with the supply to Cheriton. Under these circumstances it is as well that differences should be finally composed by fusion. It is also desired to enter into agreements for the transfer of the undertaking authorized by the Elham Valley Gas Order of 1912. Turning to the clauses of the Bill, it is seen that it is proposed to issue to the holders of ordinary or preference shares of the Hythe Company ordinary stock of the Folkestone Company. Holders of £10 nominal value of Hythe stock entitled to a standard dividend of 10 per cent. will receive £10 of the Folkestone ordinary stock; holders of £10 nominal value of the Hythe ordinary stock entitled to a dividend of 7 per cent. will receive £7 of Folkestone ordinary stock; holders of preference shares of £10 nominal value of the Hythe Company entitled to a dividend of 4 per cent. will receive £8 of ordinary stock; holders of £10 of Hythe preference shares entitled to a dividend of 5 per cent. will receive £10 of ordinary stock; holders of £10 of Hythe preference shares entitled to a dividend of 6 per cent. will receive £12 of ordinary stock. In addition, the Folkestone Company are to issue to each of the five Hythe Directors £210 of ordinary stock, and to Mr. H. Stanier, the Secretary of the Hythe Company, £500 of ordinary stock. To the holders of Hythe debenture stock, each £100 is to be entitled to £125 of 4 per cent. Folkestone debenture stock. Power is asked to create the necessary stock for the purpose of the absorption; and provision is made for the payment of the Hythe dividends up to June next. Provision is to be made for the conversion of the existing Folkestone share capital into one class of 5 per cent. stock, to be called ordinary stock; and it will be vested in the holders of shares as follows: For every £10 share entitling the holder to a dividend of 10 per cent., £20 of ordinary stock; for every £10 share entitling the holder to a dividend of 7 per cent., £14 of ordinary stock; and for every £10 share entitling the holder to a dividend of 5 per cent., £10 of ordinary stock. It is also provided that the powers conferred upon the Company by the Act of 1898 of raising further capital by shares or stock (so far as they have not been exercised) shall continue in force, and be exercisable up to July 1 next, by the issue of further amounts of shares entitling the holders to a dividend of 7 per cent., and on and after that date by the creation and issue of ordinary or preference stock. Dividends on the preference stock are not to exceed 6 per cent. per annum. In respect of the ordinary stock created for the transfer of the Hythe Company, and the ordinary shares of the Folkestone Company existing on June 30 next, the Company ask for power to borrow (including the amounts already borrowed) the sum of £77,000; and in respect of the additional capital the equivalent of one-third part. It is proposed that the Treasury clause as to the issue of capital during the war and for twelve months after, shall not apply to the stock required for the satisfaction of the Hythe shareholders's claims, nor as to the converted share capital. The proposed extension of limits of supply is defined, and here is where the Company seek to acquire the undertaking authorized by the Elham Valley Gas Order. The standard price of gas is proposed at 3s. 6d., with the sliding-scale operating half-yearly. In connection with the price of gas, the Company appear to have divided their district into three parts—the inner, the middle, and the outer areas. In the middle area, the price is not to exceed by more than 6d. the price charged in the inner area, and the price charged in the outer area is not to exceed that charged in the middle area by more than 6d. Differential prices are arranged for, with protection of consumers against preferential charges. A calorific value standard is to be substituted for the illuminating power standard; and it is proposed that the calorimeter shall be "agreed upon between the Company and the Corporation (or, failing agreement, to be approved by the Board of Trade), which shall be so constructed as to be capable of yielding the total heat value expressed in British thermal units of the gas supplied by the Company." The standard desired is a level 500 B.Th.U. Other clauses are of ordinary form. [*Parliamentary Agents: Messrs. Rees and Freres.*]

The Hornsey Gas Company are promoting a Bill with two main purposes—to define the boundary between the respective limits for their area of gas supply and that of the Gas Light and Coke Company, and to authorize the manufacture of residual products on a certain portion of the existing works. The principal clauses relating to the adjustment of boundaries are as follows:

> From and after the passing of this Act, the Company shall have the exclusive right to supply gas within the portion of the limits of supply of the Company comprising the parish of Hornsey, except in such parts thereof as are excepted from the limits of supply of the Company by section 4 of the Act of 1866, and the Hornsey Gas Acts and Orders, 1866 to 1916, shall apply accordingly: Provided always that, until the completion of the sale and purchase referred to in the section of this Act of which the marginal note is "Purchase of Certain Works of Gas Light Company," nothing contained in this section shall be deemed to prevent the Gas Light Company continuing to afford any supply of gas which they are affording at the date of the passing of this Act within any part of the said parish which is within the limits of the supply of the Company.
>
> From and after the passing of this Act, the part of the parish of Hornsey first excepted from the limits of supply of the Company by the said section 4 of the Act of 1866 shall be deemed to be part of the limits of supply of the Gas Light Company.
>
> Upon the passing of this Act, the Gas Light Company shall forthwith sell, and the Company shall forthwith purchase, all mains, pipes, and other works of the Gas Light Company within that portion of the parish of Hornsey in respect of which exclusive rights to supply gas are by this Act conferred on the Company.
>
> The consideration for such sale and purchase shall be such sum as may be agreed between the Company and the Gas Light Company, or as, failing such agreement, may be determined in accordance with the provisions of the Arbitration Act, 1889, by an arbitrator agreed upon between them, or failing such agreement, appointed by the President of the Institution of Civil Engineers, upon the application of either of the said Companies.

Provision is made as to the payment by the Company of the consideration due to the Gas Light and Coke Company, and for the preparation of maps showing the limits of supply of the two Companies so far as they are connected. The lands are scheduled on which the Company desire authorization to "work up, manufacture, and convert the residual products arising directly or indirectly from the manufacture of gas." Power is taken to form a special purposes fund and a benefit fund—the latter by the appropriation out of revenue as part of the expenditure on revenue account of any sum not exceeding ½d. per 1000 cubic feet of gas supplied during the year. But the sum so appropriated, and for the time being standing to the credit of the benefit fund, is not at any time to exceed the amount which the Directors would have been entitled to appropriate to the fund out of the revenue at the prescribed rate during the then preceding five years. A novel clause gives the Company power to apply to the general purposes of the undertaking to which capital is properly applicable the sum of £25,000, being part of money now in hand on revenue account. The money thus appropriated, it is proposed, shall form a separate class of capital, to be known as "B" capital, and is not to be treated as part of the capital entitled to dividend. There are a number of miscellaneous clauses included in the measure; but they are all more or less of general adoption in modern legislation. One that is not of general adoption, but is not novel, empowers the Directors to grant gratuities, or make such pension or other allowance or payment as they may think fit to any employee disabled, injured, or incapacitated while serving with His Majesty's forces, or, in the event of any employee being killed in action or dying of wounds, injury, or disease received or contracted while in such service, to the dependent of such employee. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Bill which is being promoted by the Imperial Continental Gas Association is to confer additional powers, to confirm the distribution of funds among the proprietors, to authorize the issue of stock at a discount, to enable the redemption of debenture stock, to permit of the holding of one meeting instead of two in a year, and to make new provisions as to the directorate. The clauses were sufficiently described in our issue for Dec. 28, p. 712. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Newcastle-upon-Tyne and Gateshead Gas Company are in Parliament for an extension of their limits of supply, for powers to construct new works, and to obtain further authority in connection with their authorized capital, in respect of which it is submitted that: "Having regard to the present state of public affairs, it would be to the advantage of the Company and the consumers of gas within the limits of supply of the Company, and would facilitate the raising by the Company on economical terms of the moneys required for the purposes of their undertaking, that the Company should be empowered to raise further moneys by the creation and issue of debenture stock." The preamble of the Bill gives some interesting information concerning the capital. The nominal amount created and issued (including the nominal amount added to the capital consequent upon the consolidation and conversion under the Company's Acts of 1873 and 1901 respectively of the ordinary and preference stocks) is: 4 per cent. preference stock, 1896, £110,166; 4 per cent. preference stock, 1901, £140,000; ordinary stock, £1,875,892—total, £2,126,058. As premiums on the sale of stock, £379,106, has been received. The amount of money received by the creation and issue of stock, including the premiums, is £1,677,594. The Company are authorized to raise a further £378,383 by the creation and issue of new ordinary stock or new preference stock. They have raised by the issue of 3½ per cent. debenture stock £529,705, and they have received by premiums on the sale of this stock £10,819. By their Acts the Company are authorized to raise a further £159,800 by the creation and issue of debenture stock. In order to meet the increasing requirements of the consumers of gas within the existing limits of supply, as well as to provide for a supply of gas within the extension of these limits, the Company will require to raise additional money by the creation of further amounts of their authorized capital; and so they make the submission already quoted regarding the debenture stock. Among the first clauses are those which deal with the extension of the limits of supply; and the parishes, urban districts, and townships in the counties of Northumberland and Durham that are included make a goodly list. It is, however, provided that the Company shall not at any time supply gas beyond the existing limits of supply if such supply would interfere with the sufficiency or efficiency of the supply within the City of Newcastle-on-Tyne and the County Borough of Gateshead. Lands are described in the schedule on which the Company may erect and maintain gasworks, and work up and convert residual products arising directly or indirectly from the manufacture of gas. The Company also include what are practically the model provisions as to the purchase of residual products from other gas undertakings; but, of course, without the one-third restriction. In the succeeding clauses, they are arranging to cease to supply gas on an illuminating power standard as from the end of this year; and for the setting-up of a level 500 B.Th.U. standard, to be tested under the prescriptions of the Metropolitan Gas Referees—the apparatus to be that which is "the most suitable for ascertaining, and shall be used in such manner, and under such conditions as to ascertain, after any necessary calculations have been made, the total heat value of the gas." Power is given to the Board of Trade to alter the calorific standard at triennial intervals, at the instance of the Company or the Corporation of Newcastle, or the Corporation of Gateshead, if satisfied that such variation should be made. Differential prices are provided for; but the Company are not to give "any preferential price as between any consumers who shall take a supply of gas for similar purposes, in similar quantities, and under similar conditions and circumstances." This clause it is proposed shall be retrospective. Succeeding are provisions as to the creation and issue of debenture stock, to bear interest at a rate not exceeding 5 per cent. per annum, "provided that the amount to be from time to time raised by the Company by debenture stock, including the amount raised by the creation and issue of debenture stock prior to the passing of this Act, shall not exceed one-half of the amount for the time being raised by the Company by the creation and issue of ordinary and preference stock." Any debenture stock created by the Company, but not issued before the passing of the present measure, "shall, notwithstanding anything contained in section 17 of the Act of 1901, or in the resolution creating such stock, bear interest at such rate not exceeding 5 per cent. per annum as shall be prescribed by resolution of the Company in general meeting." Then the repeal of so much of section 19 of the Company's Act of 1901 is asked for as provides that the reserve price put upon stock for sale by auction or tender shall not be less than the nominal amount thereof; and it is now asked that it shall be lawful for the Company, "for the purpose of any such sale by auction or tender of any such stock, to fix such reserve price as they may think fit." Another important financial provision has reference to the dividend on new preference capital. It is provided that "seven pounds" shall be deemed to have been inserted in section 15 of the Act of 1901 instead of the words "four pounds." Of course, the change will only apply to preference stock issued after the passing of the present measure. The Company also require power to create and issue as redeemable preference stock any preference stock "which they are by the Act of 1901 authorized to create and issue, and which has not been created before the passing of this Act, and the resolution creating such redeemable stock shall specify the terms and conditions on which such stock shall be redeemed." The Company take power to issue as redeemable debenture stock any debenture stock which they are, by virtue of this measure, authorized to create and issue, and also any debenture stock previously authorized but not issued. Provision is also made for the formation of a redemption fund. Included is the Treasury clause restricting the raising of money without their consent during the war and for twelve months after. [*Parliamentary Agents: Messrs. Dyson and Co.*]

In pursuance of the purchase clause inserted in the Northwich Gas Company's Act of last year, the District Council are promoting a Bill to empower the transfer. In connection with the money powers, estimates have been prepared showing that the requirements of the Council are: For the erection, extension, alteration, and improvement of the gas-works, £17,000; for new gas-mains and the extension and improvement of mains, £9000; for new services, meters, stoves, and fittings, £6000. Notice to purchase the undertaking is to be given to the Company within six months after the passing of the Act; the purchase is to be by agreement or, failing agreement, by arbitration. The Council are to pay, in addition, the costs of the Company's Act of last year, and for watching or procuring any amendment of this Bill, together with £200 in respect of the transfer of the undertaking and the winding-up of the Company. Compensation to the directors, officers, and others is provided for. The Council are to pay the purchase money on a date to be agreed upon, or on the expiration of three months from the date of the award, unless the Treasury refuse their consent to the borrowing of the money. In this event, the Company are not to be entitled to require the Council to pay the purchase money until one month after such consent is given, or the necessity for such consent ceases, whichever is the earlier. It is further provided that, if the Council do not pay the purchase money on the date of transfer, they shall pay interest thereon at the rate of 5 per cent. per annum from the date of transfer until the date of actual payment. The limits of supply are defined; and all necessary powers taken to construct and maintain gas-works. The model residuals clause (*minus* the one-third restriction) appears. A calorific value clause, setting up a standard of 500 B.Th.U., tested in the manner prescribed by the Metropolitan Gas Referees, is inserted. The fittings clause is on the model lines, providing for this branch of the business being conducted in such a manner that there shall be no loss upon it. As to financial powers, the Company seek authority to borrow the requisite amounts for the purchase of the undertaking and incidental thereto, with a repayment period of forty years; the sum necessary for discharging any debentures, mortgages, obligations, and liabilities subject to which the undertaking is transferred to the Council, with a repayment period of forty years; £17,000 for works, also with a repayment period of forty years; £9000 for new mains and extensions to, and improvements of, the distribution system, with a repayment period of thirty years; and £6000 for new services, meters, stoves, and fittings, with a repayment period of fifteen years. [*Parliamentary Agents: Messrs. Butterworth and Co.*]

ELECTRICITY SUPPLY MEMORANDA.

Lapsus Memoriæ.

The President of the Board of Trade recently remarked in Pariament that, "so far as commerce is concerned, Germany is a beaten nation; and it is our business to take good care that she does not get her head up again to the same extent after the war." Following this consoling statement, Mr. Runciman said it would be the special business of the Board of Trade to oster industry after the war, which is a highly gratifying prospect if the Board of Trade—forsooth! precedent does not give ground for great hope—is capable of such beneficent and much needed work. "Meteor" of the "Electrical Times" has his doubts. He cannot find anything in the origin, nature, and raditions of the Board to encourage hope. The effects of the Board's activities on electrical enterprise have been, according to his observer and critic, particularly blighting. He depreciates he industry. His moody condition after Christmas leads him to describe the industry as still youthful and struggling (at 33 years of statutory life!), and without powerful friends; and, under the circumstances, it has had to suffer impositions which gas would have sturdily flung aside. "The public is scrupulously protected against electricity at any cost, whereas gas may poison, maim, and burn without injury." Spotless and impeccable electrical ndustry! "Meteor" has forgotten all about poisonous and explosive gases having been generated by the heating of the insulation of fused cables; he has quite overlooked the awful list of atalities electrically produced in factories, workshops, and elsewhere; electrical troubles in coal mines, which have killed and maimed, have escaped his memory; and fled from knowledge are the gruesome happenings on subterranean electric railways. The ecord of maimings and burnings due to electricity would fill a whole number of the "Electrical Times." But "Meteor" only emembers that gas has been a guilty party in such matters. Forgetfulness, or more likely narrow-mindedness, could not have better illustration.

Thermostatic Control in Room Heating.

Mr. George Wilkinson, of Harrogate, is advocating thermostatic control in room heating, and a considerable addition to installation expenses. We fancy in this matter he is as one crying in the wilderness, and that he will have ew electrical followers, who already find that installation expenses and running costs are quite sufficient under ordinary circumtances to argue upon in trying to secure the adoption of electric heating, without having to add 55s. per room by introducing thermostatic control, as well as the extra expense of maintenance that t must involve. He assumes that a rating of 1½ watts per cubic oot of room space is sufficient for the coldest day, which it is not. Other experts consider 2 watts a necessary average; and he correct figure, whatever it may be, depends upon the conditions of the room itself. However, assuming that 1½, 2, or any other number of watts per cubic foot are correct for the coldest day, this would be a wasteful continuous consumption or every other day of the year. He maintains that the provision of one or two switches does not in any case furnish the required control—first, because such switches are seldom used, and are not used at the right time, and for the correct period; and, secondly, because the external temperature and the weather conditions are constantly varying at irregular intervals, so that no simple combination of hand-operated switches can meet the case, or prevent considerable waste of current. Therefore, in his opinion, the only economical and effective way of dealing with the heating problem is by means of thermostatic control. Different people have different ideas as to what is a comfortable temperature; and most people would object to living in a fixed temperature at all times, and in all weathers, and would prefer to obtain regulation, according to their own current feelings and requirements, by a tap in the case of gas-fires or by switches in the case of electric "fires." However, Mr. Wilkinson has devised a mercurial thermostat, which he finds answers admirably—not only with electric radiators, but with—man of catholic tastes that he is!—a gas-fire of modern type in his study. In his case, he secures a working economy in the use of the thermostat, and personal relief from the obligation of adjusting the fires to the requisite temperature. Thermostatic control has long been applied to water-heating devices in which gas is used; but we are doubtful as to any large demand for a device that would cost 55s. in every room in which a gas or electric heater is installed.

Lighting of Artizan Dwellings.

The review made last week of matters associated with the work of the electrical industry during the past year, postponed notice of a brief—and it is a very brief—reply in the "Electrician," to our comments on the article by Mr. J. Cleary, describing an experience at Brighton in the lighting of artizan dwellings. [See "Memoranda" for Dec. 14, p. 579.] The "reply" does not touch several of the points raised in our criticism, and particularly the one affecting costs—in fact, it avoids completely the most essential questions. The subject of decoration is touched upon—lightly. We are told that the cost of decoration is one that falls upon the Corporation Health Committee, and not upon the Electricity Committee; and therefore "presumably" the Health Committee are able to determine the cost. As we previously pointed out, the Health Committee are not the only people in the world who have had experience of the needs, from the points of view of cleanliness and sanitation, of redecoration in artizan dwellings; and even now our friends do not tell us whether the condemnation of gas was based upon flat-flame lighting or the use of proper incandescent lighting units. With bijou and medium lights, our ceilings in the suburbs of London go for years without the scorching due to the employment of larger sized units, or the blackening due to incomplete combustion with flat-flame burners. It is pointed out that in the low-pitched rooms of artizan dwellings, the light cannot be placed so far away from the ceilings as in houses of a better class; and if they are situated low down, the lighting is unpleasant from the point of view of glare. Our contemporary should avoid remarks which bring into comparison the, for similar candle powers, large area source of light provided by a mantle with the small area source of light provided by an electric-lamp filament. On the financial side of the question, which the "reply" evades in every particular save that of lamps, it is stated that the cost, except for meters and lamps, falls on the Health Committee, and that the charge to the Electricity Department for a new lamp is not 2s. 8d., but 1s. 7d. What does this mean? Is it that the charges in connection with the costs of the installation, excepting meters and lamps, are borne by the Health Committee, and are not chargeable upon the average income of 26s. per annum per house? If so, then how does this Brighton experience bear generally upon lighting in artizans' dwellings where there is no benevolent Health Committee to carry the cost of installation, but the electricity purveyors have to meet it, and yet make a profit on the small total revenue? Now it appears that the lamps are not 40-watt ones, but are of 50-candle power. This makes the consumption per lamp per hour upwards of 60 watts; so that, in the construction of a balance-sheet, the 60 watts would be worse for the "profit" realized than with lamps using 40 watts. On the question of glare, it is remarked that no great cost is involved in the frosting of lamps, so as to hide the filament from view, and thus avoid eye strain; and "it is understood that [at Brighton] much attention is given to suitable shades." Our contemporary's statement is evasive. It does not say whether or not the lamps are frosted that are used at Brighton; and as for shades, Mr. Cleary does not say in his original article that *all* the lamps were fitted with shades. The "Electrician" should refresh its memory on the point. However, if the lamps are frosted, they do not give an illuminating power of 50 candles—the frosting greatly depreciates the light. According to whether the frosting is light or heavy, the depreciation may be from 10 to 30 per cent.

The Percentage Wired.

An investigation has been made in Melbourne, which has shown that only 25 per cent. of the buildings are wired for electric lighting. The position is worse in London. In the volume of "Comparative Municipal Statistics, 1912-13," issued by the London County Council, it was shown that the number of electricity consumers in London is 143,980, compared with 1,223,995 gas consumers—and this difference without taking into account consumers who use other lighting agents. In view of the low percentage of premises wired in Melbourne, the City Electrical Engineer has been instructed to report upon a system of wiring by which the cost will be repaid by the consumers in monthly instalments. Objections have been raised to the scheme on the ground that companies who have embarked on schemes of assisted wiring have almost in all cases been unsuccessful with them, and, secondly, that they involve competition by the Corporation with wiring contractors.

Trade Teachings in School Questions. A correspondent tells us that at one of the branches of Clark's Colleges, Limited, he came across a question in which he thought we should be interested, and those who were guilty of the folly of putting the question might be corrected. In effect, if not in actual words, this was the proposition and inquiry put before the student for consideration and answer: "For house lighting in a certain town, gas costs 3s. 5d. per 1000 cubic feet, and electricity 4d. per unit; and eight units of electricity give as much light as 1000 cubic feet of gas. Which is cheaper to light a house with if the same amount of light is provided in either case? And what difference is there between the two systems for a house that would use 77,000 cubic feet of gas?" In the first place the "facts" on which the question is founded are not correct. In normal times, the major part of the gas consumed in the United Kingdom is sold—in London and the large provincial centres—at 2s. 6d. and below per 1000 cubic feet; and we do not know of any town where gas is sold at 3s. 5d. per 1000 cubic feet where the price of electricity is as low as 4d. per unit. Even in London 5d. and 5½d. are not unknown prices for lighting purposes. Then the statement that eight units of electricity give as much light as 1000 cubic feet of gas is incapable of photometrical substantiation. Using metallic filament lamps, the utmost illumination that can be secured from a unit of electricity is 800 candle-hours; while the modern recognized types of inverted incandescent gas-burners will easily return 20 candles per cubic foot of gas, which equals 20,000 candle-hours per 1000 cubic feet. Therefore, 20,000 ÷ 800 = 25. In other words, to realize positively the same illumination with electricity as can be secured by consuming 1000 cubic feet of gas, 25 units and not eight would be required. Eight units would only supply 6400 candle-hours. How such a silly comparison got afloat as the one presented in the question, we cannot understand, seeing it is demonstrably inaccurate. It is the simplest thing in the world to show the inaccuracy within the walls of a photometer-room. On the revised comparison, the cost of the 77,000 cubic feet at the truly rural price (in normal times) of 3s. 5d. per 1000 cubic feet would be £13 3s. 1d. On the basis of 800 candle-hours per unit of electricity and 20 candle-hours per cubic foot of gas, 1925 units of electricity would be required to produce an equivalent illumination to the 77,000 cubic feet of gas. At the very low price of 4d. per unit for a town in which gas is sold at 3s. 5d., the 1925 units would cost £32 1s. 8d.; so that the difference in cost to the householder would be for equal illumination £18 18s. 7d. Now what explanation have the propounders of the question (who may not be Clark's College, but the author of a book used there) to make as to its absurd terms; and how many marks are allowed for the answer to the question which we have given here?

Household Refuse. Refuse destruction used to be a fairly frequent subject of discussion in connection with steam-raising for electricity generation; but for some years it has gone out of fashion as a topic of debate. The fact is that combined dust destruction and steam-raising as economic factors in connection with municipal work do not constitute a subject lending itself to general discussion. While in one town the system allows a decent balance-sheet to be made out owing to the excellent burning character of the refuse, the moderate expense of collection through the lie of the town, and also the moderate cost of sorting, in another town the conditions may be altogether reversed, so that the experience of one town will not always fit another. In the "Electrical Times," the topic has been revived by an article contributed by Mr. L. L. Robinson, of the Hackney Electricity Department; and he does not think there is really very much in the system, judging from his own figures, as an economical method of disposing of refuse. In the correspondence the article has produced, one writer shows he is doing very well out of refuse destruction; but his district is as unlike the Hackney area as it can possibly be. But Mr. Robinson cannot see that the costs of refuse collection and destruction are likely to improve, owing to the increasing difficulties of disposing of the clinker, and the additional value put by labour upon its own exertions. In view of this, he suggests that it should be made compulsory for householders to consume the combustible portion of their own house refuse, which amounts to about 60 per cent. of the total; and the balance—the 40 per cent.—he would have them sort out into four bins, instead of putting it all into one. Into one bin he would have the ashes put; into the second, bones; into the third, glass bottles, crockery, and jam pots; and into the fourth, tins and other old metal articles. Mr. Robinson calls the present-day methods of refuse collection and disposal wasteful, and the plan he proposes an improvement. We can see landlords providing four bins instead of one; we can likewise see householders relieving the local authorities of the highly enjoyable task of sorting out refuse in the manner that he suggests. The gas industry goes one better than Mr. Robinson. It offers the householders methods of cooking and heating, which make no combustible refuse; and it suggests the use of very nice coke and refuse burning boilers, for maintaining a constant supply of hot water in the house. The beauties of this system are that local economy is largely served by entirely doing away with the collection of a large portion of the refuse at present made; that it reduces the number of collections to be made, and the amount of sorting at the local depôt; and that it does away with the necessity of a destructor, and the carting of a large proportion of the refuse through the streets. Altogether, the gas plan is a very sanitary one; and it is a wonder that it did not occur to Mr. Robinson to incorporate it in his article.

COAL STATISTICS FOR 1914.

Some Falling Off in Output.

The first few months of war conditions, of course, affected the statistics contained in the Annual Report on Mines and Quarries for 1914, Part III. of which (dealing with output) was issued as a Blue-Book last week. Owing to the war, also, this part of the report, Mr. R. A. S. Redmayne (Chief Inspector of Mines) points out, has been considerably curtailed, so that the form in which the statistics are presented is likewise affected. Some of the tables with which those who are in the habit of studying the report have become familiar are on this occasion omitted—among them, those relating to exports and imports of coal. However, though the report has been pruned down from 130 to some 20 foolscap pages (and other minerals are, of course, dealt with besides coal and coke) there are still be found in it most of the figures which year by year have been quoted from it in the "Journal" for purposes of comparison.

The output of coal in 1914 was 265,664,393 tons, of a value at the mines and quarries of £132,596,853. When compared with 1913, these figures show a decrease in output of 21,766,080 tons, and in value of £12,938,816; the actual totals for the year being an output of 287,430,473 tons, having a value of £145,535,669. For 1912 (the year of the great coal strike) the output was 260,416,338 tons, value £117,921,123; for 1911, 271,891,899 tons, value £110,783,682; 1910, 264,433,028 tons, value £108,377,567; and 1909, 263,774,312 tons, value £106,274,900. The average price of coal at the pit was 9s. 11·79d. per ton in 1914, compared with 10s. 1·52d. in 1913. The value of the coal at the mines for each of the preceding four years was: In 1912, 9s. 0·68d.; 1911, 8s. 1·79d.; 1910, 8s. 2·36d.; and 1909, 8s. 0·7d. Thus, though the figure for 1914 is something less than 2d. per ton lower than was the case in the twelve months immediately preceding, it is still very much higher than in any of the four other years named.

Of the total falling off in output for the year under review of 21,766,080 tons, there was a decrease in the English fields of 15,383,991 tons, in Wales of 2,782,814 tons, and in Scotland of 3,609,154 tons. Ireland, on the other hand, has a gain credited to it of 9879 tons. The complete figures for 1914 were: England, 184,545,577 tons, of a value of £89,523,440; Wales, 42,179,054 tons, value £25,530,993; Scotland, 38,847,362 tons, value £17,487,427; Ireland, 92,400 tons, value £54,993. The total output of anthracite (which is as usual included in the statistics relating to coal) for the twelve months was 4,718,993 tons, which was valued at £2,711,172. This is somewhat less than in the preceding year, when the output was 5,194,620 tons, and the value £3,089,847.

The customary table showing the prices of coal at the pit's mouth in the different fields is not included in the present report; but the figures are given for each county where coal is raised. From these it is seen that, in the case of England, the approximate price per ton of coal at the mines varied from 7s. 0·67d. in Worcester to 13s. 4d. in Westmorland; the average being 9s. 8·43d. For Wales, the highest figure was 12s. 5·48d. in respect of part of the output from Glamorgan, and the lowest 8s. 10·97d. for part of the coal coming from Carmarthen; the average working out at 12s. 1·27d. In the case of Scotland, Dumbarton was at the top with 10s. 11·58d., and Haddington lowest with 7s. 9·03d.; the average being 9s. 0·04d. With Ireland, the figures varied from 12s. 4·24d. in Kilkenny to 9s. 5·02d. in Tyrone; the average working out at 11s. 10·84d. As already mentioned, the average for the whole of the fields was 9s. 11·79d. per ton. The mean price of seaborne coal in the London market during 1914 was 21s. per ton. This was the same as in the preceding year; while the corresponding figures were 20s. 11d. per ton in 1912, 17s. in 1911, 16s. 3d. in 1910, and 16s. 11d. in 1909.

The quantity of coal exported (exclusive of coke and manufactured fuel and of coal shipped for the use of steamers engaged in foreign trade) was 59,039,880 tons, compared with 73,400,118 tons—or a decrease of some 14,000,000 tons. In 1912, the exports were 64.444,395 tons; in 1911, 64,599,266 tons. In the twelve months now under review, there was also, in addition to the quantity just named, the equivalent of 1,971,413 tons of coal exported in the shape of 1,182,848 tons of coke, and the equivalent of 1,446,981 tons of coal in the form of 1,607,757 tons of manufactured fuel. If to this there are added the 18,535,616 tons of coal shipped for use of steamers engaged in foreign trade, a figure is arrived at for the total exports of coal and coal equivalents of 80,993,890 tons, as compared with 98,338,104 tons in 1913, and 85,842,905 tons in 1912.

Of the exports during 1914 of coal as such, France received over 12¼ million tons, Italy 8½ million tons, Germany 5¼ million tons. In round figures, the quantity which was taken by France in 1913 was 13 million tons, by Italy 10 million tons, by Germany

9 million tons. Of the total quantity of 265,664,393 tons of coal raised in 1914, the amount remaining for home consumption for all purposes was 184,670,503 tons, or 3·977 tons per head of the population of the United Kingdom, as compared with 4·108 tons per head for the year before. In 1912, the quantity which remained for home consumption was equal to 3·823 tons per head of the population. Of last year's total, 36,289,010 tons were used in the manufacture of coke and briquettes, and 18,381,106 tons in the blast-furnaces for the manufacture of pig iron; these figures comparing with 39,560,489 tons and 21,223,607 tons respectively in the previous year.

Production of Coke.

The following four pages of the report furnish particulars with reference to the production of coke and briquettes and the number of coke-ovens in use in 1914. Returns of production of coke were received from 144 colliery owners (comprising 190 separate works), 1500 gas companies, and 21 other owners of coke-ovens. The counties of Durham and York furnished 64 per cent. of the total quantity of coke made in coking-ovens; 63 per cent. of the total number of ovens being worked in these counties. Of the 211 works other than gas-works where coking-plant is in use, bye-products—principally sulphate of ammonia and tar—were recovered last year in 103. This is a substantial improvement on 1913, when the figure was 88. With regard to briquettes, returns were obtained from all firms—mainly in South Wales—known to be engaged in the industry of manufacturing them; the material used being very fine slack.

The total quantity of coal used in the manufacture of coke in 1914 is put at 34,539,859 tons; the amount of coke obtained being 18,970,925 tons—7,920,669 tons from gas-works, and 11,050,256 tons at coke-ovens—of a total value of £13,252,526. In the previous year, there was an output of 7,830,736 tons from gas-works, and of 12,798,996 tons at coke-ovens; the total being 20,629,732 tons. Of the output from gas-works, 6,758,871 tons came from England, 155,930 tons from Wales, 806,763 tons from Scotland, 189,177 tons from Ireland, and 9928 tons from the Isle of Man. There were 16,975 coke-ovens in use; 9210 of them being of the beehive type. Of the remainder the four styles most largely in use were the Otto-Hilgenstock 1589, Coppée 1538, Simon-Carvés 1354, Semet-Solvay 1134, and Koppers 866. There were 1,840,465 tons of briquettes produced, of a selling price at the place of manufacture of £1,567,474.

Other Minerals.

The tables with regard to the output of bog ore and natural gas are not given; but the figures are not in either case usually of very large dimensions. During the year now being dealt with the output of iron ore was 8,984,492 tons, valued at £3,267,987, from mines, and 5,883,090 tons, valued at £653,696, from quarries in the United Kingdom. Thus the total output was 14,867,582 tons, the yield of iron from which was 4,786,090 tons, as compared with 15,997,328 tons in 1913. The output of oil shale from mines and quarries for 1914 was 3,268,666 tons. The average price per ton at the mines was 5s. 1·47d.; the total value being £837,249. The figures for 1913 were 3,280,143 tons, of a value of £822,394. The average yield of oil is put at 22 gallons per ton of shale, and of sulphate of ammonia at 44 lbs. The quantity of petroleum imported into the United Kingdom in the year under notice was 646,712,631 gallons; the value placed upon it being £12,756,207. This was 158,605,668 gallons and £1,899,401 value more than in the preceding year.

GAS-MANTLE METALS.

NO. 1.—CERIUM.

By James Scott.

[The diagrams by which the present article is illustrated were prepared by the author from enlarged microscopic slides.]

One of the most important, yet little known, industrial metals is cerium, which forms part of the substance of incandescent gas-mantles. Though the oxides of several metals—including aluminium and chromium—have been tested in connection with the manufacture and use of these inestimable articles of lighting utility, those composed of cerium and thorium still stand supreme. These are the main ingredients of the Welsbach mantle and its modifications.

A brief explanation is needed before the author describes the principal properties of the metal named in the heading. The mantles mentioned consist of fine cotton nets, which are dipped into a solution containing 99 per cent. of thorium nitrate and 1 per cent. of cerium nitrate. These proportions have been found to yield the most excellent results. When the amount of cerium is either larger or smaller, inferior results follow. Upon withdrawing and draining the nets, they get neatly covered with a nitrated film of the metals, and when this is ignited in the specialized form of burner it is at once oxidized and rendered incandescent. The film matter between the meshes gets burnt out, but is retained in the interstices between the cotton fibres.

Dealing in alphabetical order with the two components, cerium and thorium, the latter will claim attention in a subsequent article. Cerium is a comparatively rare metal, and was only a few years ago (owing to its former absolute scarcity) quite a mystery to most scientists. Even now it seems to be dealt with within a limited circle; so that the accompanying series of illustrations, prepared from the author's own experiments and observations, will be found fresh and novel. The metal is a constituent of many minerals, including cerite and orthite, which also contain kindred elements in conjunction with silica. For its commercial production its chloride is carefully electrolyzed. Lately, certain sand is used.

When properly isolated, cerium is a hard, heavy, lustrous steel grey metal; and will readily yield flashes of light and sparks when gently scraped with a pen-knife. Thinking that this phase was worth investigation the author held a glass slide between the base of his left-hand thumb and finger, while the tips of the same grasped a piece of cerium. By scratching the metal in the manner just described, some of the minute products of combustion were caught on the under-side of the glass, thereby becoming available for magnification. It was found that the friction caused the minute discharged particles to assume the form of spheres, which were dark in colour, and that these exploded on their own account if not interfered with. These shelled globules cut saucer-shaped depressions into the glass against which they struck. Most of these objects were caught before they had time to glow to extinction, though some of them had burst and scattered their contents around on the glass.

By making close observations on the procedure through the microscope while the sparks developed, the following conclusions, aided by the preceding facts, were arrived at.

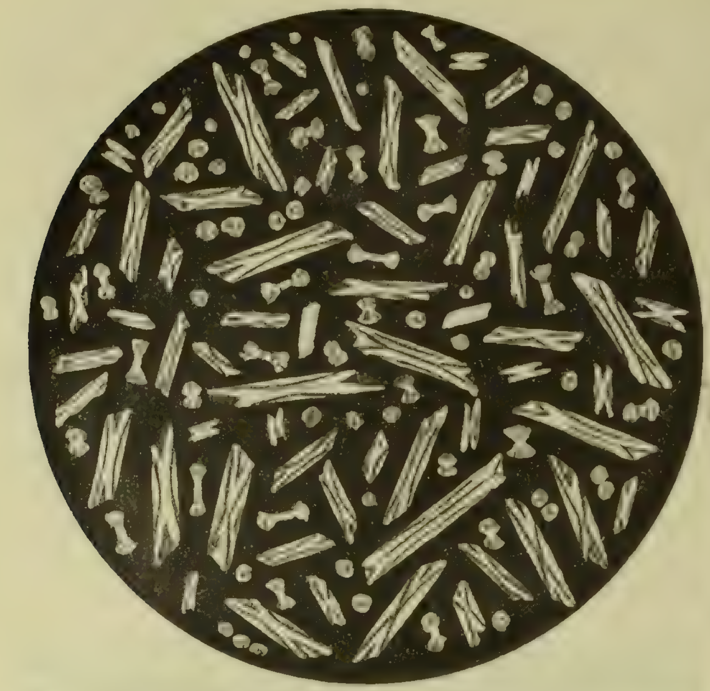
No. 1.—A Piece of Cerium that has just been scraped with a Knife-edge. Brilliant Flashes and Sparks are instantly caused.

In fig. 1 is depicted a view of the sparks formed after cerium has been scratched. In the usual course of conduct, particles, as they are ejected from the cerium, become white hot, and, as a result of melting and projection, are moulded to globular shape. The contents get hotter still, owing to the formation of a surface shell round the globule, which thus encloses them; and, in consequence, they force their way outwards, still glowing. There is no doubt that the larger pieces thus removed become spherical and repeat the manifestations, but on a reduced scale. All the movements, however, occur within a second or so, and it is not an easy matter to follow them. This phase is worth studying.

Cerium oxidizes very rapidly, and needs the closest protection if it is desired to keep it in its purely metallic state. The bright surface is succeeded by a dull one; and it gradually breaks-down into a fine grey powder. Upon magnifying an undisturbed piece of the metal in this condition, it was found that it consisted of exceptionally minute particles; the specks being detachable at the slightest touch. Prior to this development, the surface was fairly even and smooth. It then cracked into small lumps, and these again divided into more minute ones, until finally the metal had been transformed into the merest specks.

An effective way of demonstrating the incandescent qualities of cerium oxide is to place some of the powder on the end of an erect rod of carbon and concentrate the flame of a blow-pipe upon it. It will soon sparkle and flash most brilliantly, and give a bright, luminous flame. Similar phenomena follow if the oxide is dropped upon a red-hot poker, or into a fire.

It should be remembered that the salts of a metal are often as valuable in many directions as the metal itself. A metallic salt, although it is apparently so different from its metal, is practically a modification of it, and can generally be made to yield up the metal by means of suitable decomposition. Briefly stated, the burning of an ordinary gas-flame results in the production and wasting of heat with a consequent loss of luminosity. Carbon

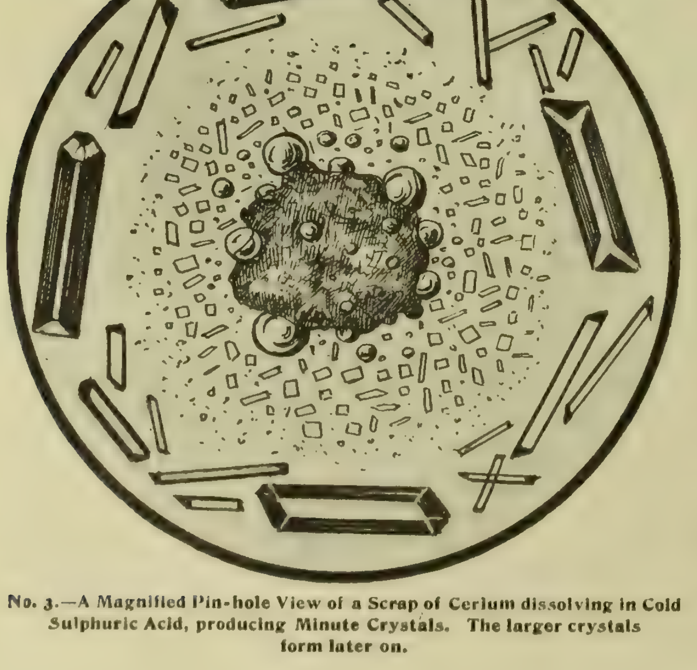


No. 2.—A Magnified Pin-hole View of Cerium dissolved in Hot Sulphuric Acid, producing Peculiar Prismatic Crystals.

molecules are ejected in clouds, and first get simply heated without revealing their presence. Hence the inner invisible part of an ordinary gas-flame looks opaque and black until something is held close behind it, when it is found to be transparent. As these heated molecules rise, they become white hot, and visible as the luminous flame. They finally vanish in a gaseous state into the surrounding air. The blue, inner layer of flame, or core, is the beginning of luminosity—its supply of oxygen being small. By substituting a suitable metallic oxide for the carbon, and using a burner constructed on the bunsen principle, the heat produced acts on its particles and causes them to become uniformly white hot—*i.e.*, incandescent.

The chief salts of cerium are orange red in colour; while the bulk of the remainder are yellowish. In many cases, however (especially when dealt with microscopically), they are transparent white, or, more correctly speaking, glassy-white. The results of the author's experiments in connection with the metal and the three most-used acids—nitric, sulphuric, and hydrochloric—may prove interesting. In each case a few drops of the concentrated acid were placed on a glass slide, and a small scrap of the metal then introduced. The results thereafter obtained are described in the following lines.

The substances were first heated, and it was found that the nitrated metal produced an amorphous or a semi-crystalline salt, which, however, was so deliquescent that it quickly redissolved. It was during the latter phase that the tendency to become crystalline manifested itself. This moisture attraction was quite a common feature among the heated compounds of cerium and acid. Similar shapeless products occurred when the acid and dissolved metal were left in the cold state. When the diluted acid was used, nothing particular in the way of contrasts was noticeable, whether heat was, or was not, applied.

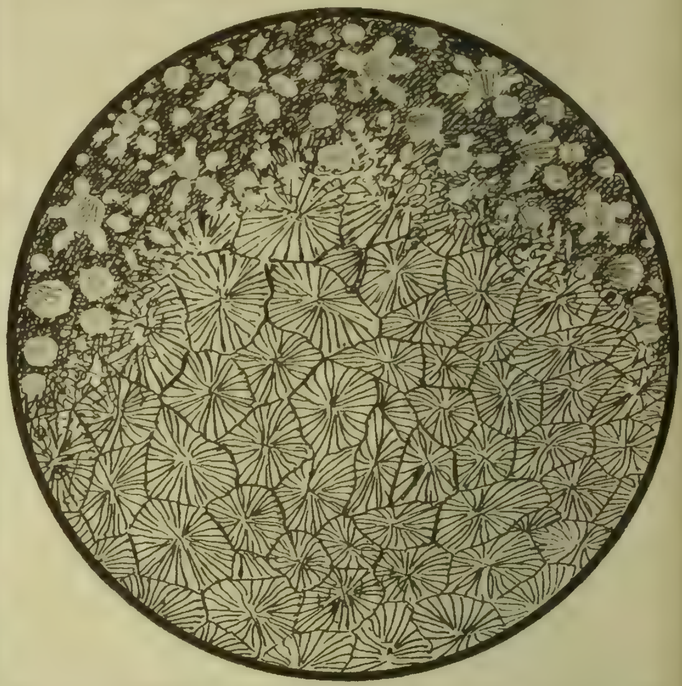


No. 3.—A Magnified Pin-hole View of a Scrap of Cerium dissolving in Cold Sulphuric Acid, producing Minute Crystals. The larger crystals form later on.

The conduct of sulphuric acid in connection with cerium was very attractive, and minutely various. Upon heating the compound there rapidly formed a glistening powder, which, upon magnification, was found to be entirely crystalline, as shown in fig. 2. Within a short time the objects began to dissolve away, and there were substituted for them some very bold rhombic crystals.

It will be seen that among the prisms are some globular forms, which, by halving and the intervention of narrow connections, become dumb-bell shaped. In some cases they resemble two fans with the handle-points placed together.

When the cold acid alone was used, there first appeared exceedingly minute and transparent, yet perfectly geometrical, crystals, of the kind shown in fig. 3. The next day the crystals that had formed were large, beautifully symmetrical, and clear. Some of them, selected and transferred from another slide, are arranged round the margin of fig. 3.



No. 4.—A Magnified Pin-hole View of Cerium dissolved in Hot Hydrochloric Acid. It is deliquescent, and reforms into Boat-shaped and Pointed Flakes.

The diluted acid and metal, when heated, produced some pretty rosettes, tufts, and hexagons. When left cold, the result was similar to that of the cold concentrated acid, but less striking.

Some very neat effects were occasioned by the interaction of the metal and hydrochloric acid, when heated. If not too thick, the film formed into a polygonal pattern, with rosetted figuring in each mesh. In the crusty portions, an opacity was produced, among which perforations were frequently arranged in the manner depicted in fig. 4. These things deliquesced to a mass of boat-shaped, scaly, and notched flakes arranged very peculiarly.

The cold acid yielded small spheres, mostly creased and folded, and some mimicked roses seen in the top view. The diluted acid, when heated, caused similar results to the concentrated one; but of less effective character. Diluted acid, left cold with the metal, yielded weaker replicas of that engendered by the strong acid.

Loss of Bye-Products in Beehive Oven Coke Making.—According to the fifth annual report (issued on the 21st ult.) of the Director of the United States Bureau of Mines, for the twelve months to June last, the value of the bye-products annually lost in the States through the coking of coal in beehive ovens amounts to more than $40,000,000. The wastefulness of the beehive oven has long been known; but only recently, he remarks, has the pressing need of recovering these bye-products and of building-up a bye-product industry—including the manufacture of dyestuffs and other coal-tar derivatives—been made clearly evident. The Bureau has often called attention to the possibilities of the bye-product industry and to the work necessary for its upbuilding.

Southern District Association of Gas Engineers.—Mr. H. C. Head, of Winchester (the Hon. Secretary), is sending out a circular to members informing them that a meeting of the Association, at which it is expected that Mr. F. L. Halford, Mr. H. O. Carr, and Mr. W. Doig Gibb will be present, will be held at 2.30 on Thursday, the 27th inst., at the Royal Society of Arts, Adelphi, when an informal discussion will take place on toluol, the extraction of explosives, the disposal of tar and dehydrated tar, oil washing, naphthalene, &c. The proceedings will be confidential, and will not be reported in the Press. After the meeting, tea will be served. The President (Mr. J. W. Auchterlonie, of Cambridge) feels that in the national work of the provision of toluene and other explosives the Association should take an active part, and trusts all the members will make a special effort to attend.

INDUSTRIAL GAS: ITS SERVICES TO THE NATION.

By H. M. Thornton, M.Inst.Mech.E.

On the invitation of the Derby Society of Engineers, Mr. H. M. Thornton, of the Richmond Gas Stove and Meter Company, Limited, yesterday (Monday) evening, delivered a lecture, illustrated by lantern slides, on "Industrial Gas: Its Services to the Nation." The Sessional Chairman of the Society (whose meetings are held in the Lecture Hall of the Mechanics' Institute) is Mr. J. Ferguson Bell, M.Inst.C.E., the Engineer and Manager of the Derby Gas Company; and gas engineers from neighbouring undertakings had been invited by him to be present to hear the lecture.

My subject to-night, I am glad to say, is of immediate and practical interest. During this time of crisis that our nation is passing through, our standard of value—both of individuals and of industries—is the contribution that is made to our national strength. Judged by this standard, our topic this evening "Industrial Gas"—or, to put it more clearly, "The Use of Coal Gas for Industrial Purposes"—will not be found wanting. The measure of opportunity is the measure of responsibility; and your Chairman would be able, better than myself, to tell you of the immediate and complete response that was made by the gas industry in all its branches to the demands created by the requirements of the Government. It is, however, the uses of gas rather than its manufacture with which I want to deal to-night, and, as the title of the lecture indicates, "Its services to the nation"—to which might be added the words "In time of war."

I should have liked—and I am sure that it could not have failed to have been of interest to you—to have dealt to-night with the multifarious practical application that has been made of gas in our principal manufacturing processes. The limits of time at my disposal prevent my going into these in detail; but anyone who would like information on the subject will find it in my lecture to the Royal Society of Arts in March of last year, when I dealt with the "Uses of Coal Gas for Industrial Purposes."* To-night, however, in this time of war, I wish to devote my paper to the part which gas is playing in the manufacture of munitions; and even here I must omit reference to munitions of war other than those composed of metals, chiefly steel. It would be desirable, first, to briefly describe some of the representative gas-furnaces used in the production of war materials—viz., shells, cartridge cases, machine gun barrel hardening, sword and bayonet forging and hardening, aeroplane, submarine, and motor-engine parts, army transport vehicles, &c., &c.

Representative Furnaces.

The gas-furnace found its first useful application in metallurgical laboratories in the form of enclosed bunsen burners, small muffle, and injector furnaces, by the use of which the research man soon discovered the reliable qualities of coal gas as a heating agent. These laboratory appliances, however, were not of that practical character necessary in the industrial operations, as the time occupied and the cost of fuel were not important factors in the pursuits of the scientist and chemist. The stage of development at which gas-furnaces have to-day arrived from these early beginnings has been the result of prolonged investigation of practical requirements. It is not my intention this evening to recount any of the successive stages through which the gas-furnace has passed; but it is now an accepted fact that for large and small industrial heating operations gas-furnaces have achieved a positive success, and that their application is well established for a great variety of heat treatments—carburizing, re-heating, hardening, annealing of steel and non-ferrous metals, glass-blowing and annealing glass, and a hundred other interesting applications that have been the subject of lectures on several occasions.

During recent years we have witnessed continuous progress in the production of all kinds of machinery and special mechanical tools. A glance at the leading engineering papers reveals the enormous amount of work which has brought machinery and its component parts to such a marvellous stage of subdivision, perfection, and efficiency. In the earlier days of engineering, when machinery was in most cases run at comparatively low speeds, the blacksmith's hearth was considered suitable for the restricted demand for what we term to-day "heat-treatment"—I refer, of course, to the heating operation of the smaller parts of machinery and tools produced at that time. Gas-furnaces have grown apace with these developments; and their application to-day in the production of war materials is positive proof of the numerous claims that have been put forward advocating their use in place of the more crude methods pursued in the heat treatment of metals.

Design of Gas-Furnaces.

It would be a mistake to assume that one particular type or design of furnace is of universal application. A furnace that can be used for any kind of operation is probably not much good for any one of them. We must discriminate; and experience has shown us that the more useful types may be divided into three distinct classes:

A.—Natural-draught furnaces, which may in the great majority of cases be used for temperatures up to 800° C. or thereabouts, and in some cases above.

B.—Furnaces with gas at low pressure and fan draught, suitable for temperature between 800° and 1400° C.

C.—Low-pressure gas and air blast, or high-pressure gas, for small furnaces where high working temperatures are required in a small furnace chamber.

Natural Draught Furnaces.

Adverting to the first-mentioned system—the natural draught regenerator oven furnace—this is heated with a series of bunsen burners which enter the combustion chamber of the furnace. Combustion is supported and intensified by secondary air entering the combustion chamber, playing under the furnace floor, and surrounding the walls and roof, causing a radiant heat to be equally distributed over the whole area of the furnace. This type will heat up from cold to a temperature of 800° C. in from 50 to 60 minutes, when the furnace walls become thoroughly soaked with heat. It is possible to work under the most desirable conditions—viz., "non-scaling," if not altogether a reducing atmosphere—by simply regulating the secondary air supplies and flue dampers, which adjustment will differ according to the local conditions of gas supplies—viz., the calorific value and pressure at which gas is delivered at the furnace. For the light operations of re-heating gears and such work, this type of furnace will be found most satisfactory.

Up to quite recently—notably in America—gas with air blast was exclusively used for low-temperature work; but there are objections to the use of gas with air blast for low-temperature work in oven furnaces. If a temperature of 750° C. is to be maintained in an oven furnace—say, 3 feet deep by 2 feet wide by 1 foot high (a standard size)—the natural-draught regenerative system will give an even and soaking heat; but if gas and air blast be used at such low temperature, the heat in the furnace chamber is invariably found to be uneven, because the local heating or blowpipe effect of the several gas and air-blast burners will not distribute heat at this low temperature in such an even manner as the natural-draught system. To further illustrate the efficiency of this furnace, I may state that temperatures up to 1300° C., or 2373° Fahr., have been obtained, which is a fine achievement for natural draught.

Another furnace, resembling this one in design, is the natural draught reverberatory oven furnace. In one point this differs essentially from the previous furnace—viz., its combustion chamber is the working chamber also. Like its precursor, it is on the natural draught principle, requiring no mechanical draught for air compression. It is heated on the reverberatory idea. The gas enters the furnace chamber, and preheated air runs along the furnace bottom through fire-clay nostrils; the hot air meeting the burner mouth at the point where combustion takes place. The flame then passes along the underside of the furnace roof before entering the flues underneath to the furnace floor, which is of exceptional strength to suit the heavier class of work. This furnace is quite satisfactory for working temperatures up to 1000° C.—viz., for carburizing, re-heating, &c.—and is a very suitable type for use where there are no convenient means of employing power-driven fans. The brickwork or linings are very substantial, and absorb a good reserve of heat, on account of the tortuous way through which the heated products of combustion travel. It is possible to hold one's hand over the head of the flue of one of these furnaces after it has been in operation for six hours on case-hardening work—a continuous temperature of not less than 950° C.

Low-Pressure Gas and Air Furnaces.

A new method of heating furnaces has recently been introduced, known as the "L.P.G.A." system (low-pressure gas and air). The principles involved have been successfully applied to the oven furnaces, also for forging work and for metal melting. For the last-mentioned work, the furnace can be constructed in either the crucible or oven type. In the "L.P.G.A." furnaces, means have been adopted to heat the whole of the air supply necessary for combustion, which takes place in the furnace chamber in such a manner as to render it unnecessary to employ the usual bunsen burners with a secondary air supply. Combustion of the mixture of gas and air is so near perfection that no excess of air is required, and therefore no heat is dissipated by the carrying-off of the excess air at a high temperature, as is the case with furnaces less well regulated as regards the admission of air. The combination of the entire preheating of air with the complete theoretical proportions of gas and hot air results in very economical working; the only heat losses being those necessarily incurred by slight radiation from the outside of the furnace and from the flues.

The working of the "L.P.G.A." furnace may be briefly described as follows: Town gas at the normal pressure enters the furnace chamber through a series of tubes from the gas-main supply. Air at approximately 2 inches water-gauge—the same pressure as the gas, or thereabouts—enters the fire-brick lining of the furnace

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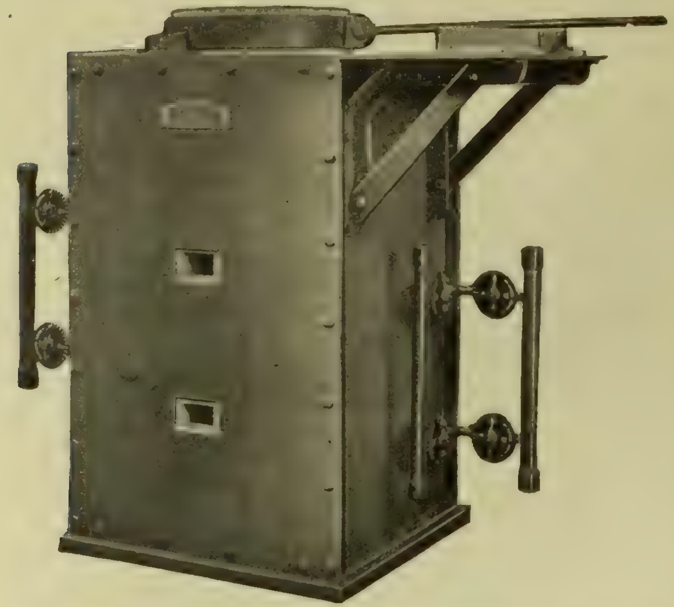
* See "Journal," Vol. CXXIX., pp. 743-750.



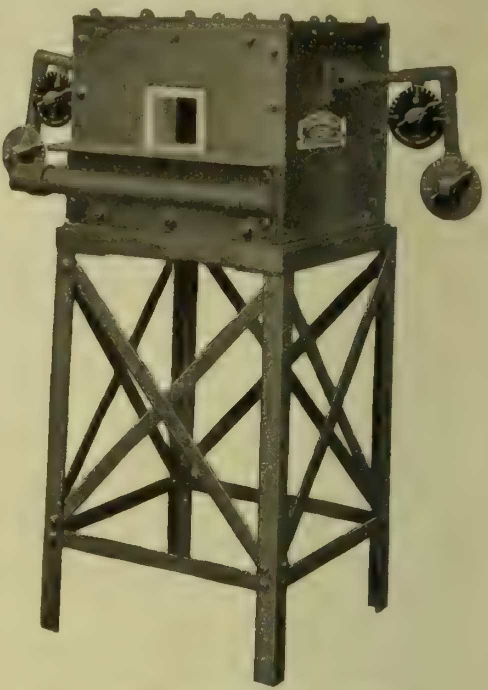
Richmond's Vertical Hardening Muffle Furnace for Machine-Gun Barrels.

through a series of tubes from the air-main supplies, and travels down the side and along the bottom of the furnace through the fire-clay tubes. The air, thus efficiently preheated, meets the incoming gas as described above, at which point combustion takes place. The products of combustion then pass along the underside of the furnace before entering the flue or flues, the air for supporting combustion above described being preheated by the waste products. The local heating effect of the blast flame and the usual combustion chamber are thus obviated.

A reducing atmosphere may be maintained under the most economical conditions by simply diminishing the pressure at the air-main. Air is usually supplied by a fan; so that the expensive blowers, with their costs for power to drive them, can be dispensed with. By the use of valves or cocks upon the main gas and air supply pipes, the furnace may be regulated for temperatures to a very fine degree. It is usual to fix pressure gauges on the outlet side of the cocks or valves; so that having first arrived at the correct respective pressures of gas and air to give the results desired in the furnaces, the subsequent regulation is simple—it being only necessary to close or open the valves to give proportionate pressure of gas and air. For example, the pressures of gas and air to give a certain temperature are respectively 10-10ths and 8-10ths of an inch. To reduce the consumption to one-half, the valves are reduced to 2·5 inches for gas and 0·2 inch for air, when the exact mixture as before the reduction is maintained.

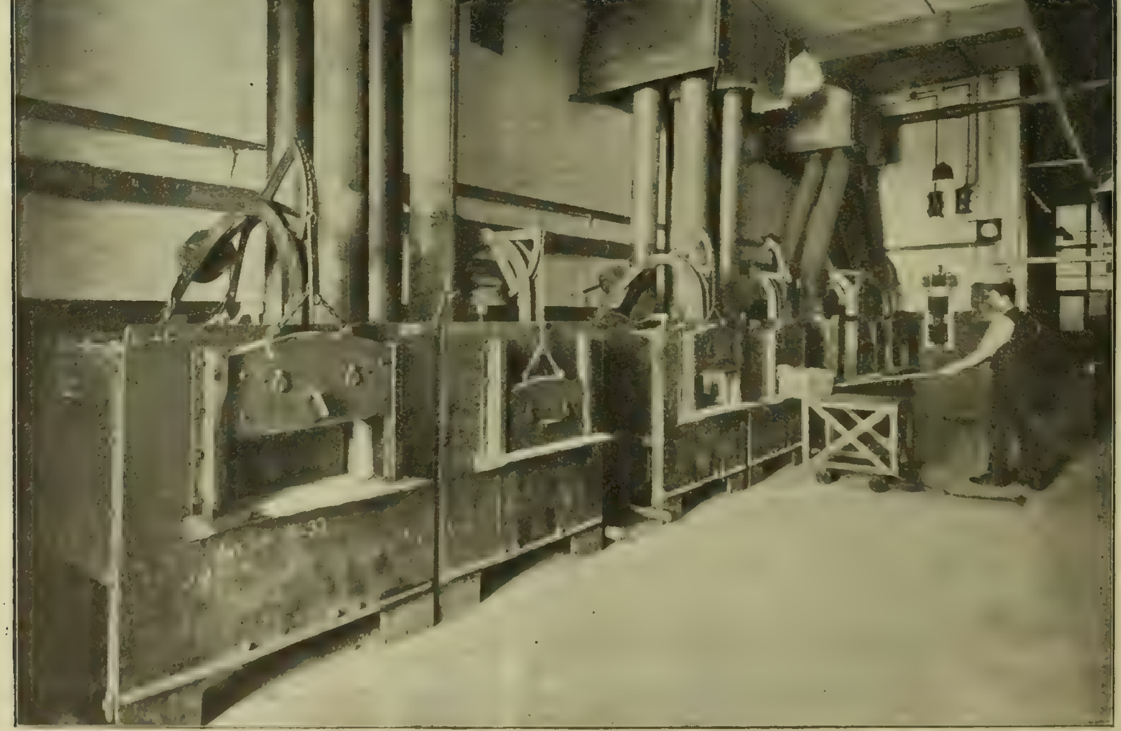
This method of regulation saves a great deal of trouble, obviating the adjustment of numerous gas and air cocks. Local adjustment can be made. if desired, by the usual taps or gas inlets and slides on the air tubes. It is desirable (particularly where a non-oxidizing atmosphere is required) to work the furnace with a slight pressure inside it—*i.e.*, a small amount of flame should come out of the peep-holes in the door when these are open. This prevents the indrawing of air through the door—a condition which should be avoided in the construction of furnaces.

Each flue is efficiently controlled by double dampers; and it cannot be too much emphasized that, in order to obtain the best results in this or any other furnaces, the flue regulation must be looked to when altering the rate of combustion. When the above-mentioned details have been attended to, a perfectly even temperature throughout can be depended upon; and the conditions of heating can be either neutral, reducing, or oxydizing. The floor of the furnace may be constructed to take any weight of material desired per square foot; bricks may be used in lieu of floor tiles. Furnaces can also be of the bogey type if required. For forging furnaces, crucible, and lead and salt bath hardening furnaces, the principles of construction are the same, with some slight modifications.



Richmond's Gas and Air Blast Furnace.

From the point of view of economy in gas consumption, steel has recently been annealed in an "L.P.G.A." furnace capable of taking eight or nine tons with a consumption of 3000 cubic feet per ton, when six tons were being treated per charge. It is anticipated that even better results will be obtained with the furnace



POT HARDENING COMPONENT PARTS OF RIFLES IN RICHMOND'S REVERBERATORY OVEN FURNACES.

working at full load—viz., nine tons. The reheating of billets for rolling has been achieved in Sheffield at the rate of under 3500 cubic feet per ton; the material being heated to over 1100° C.

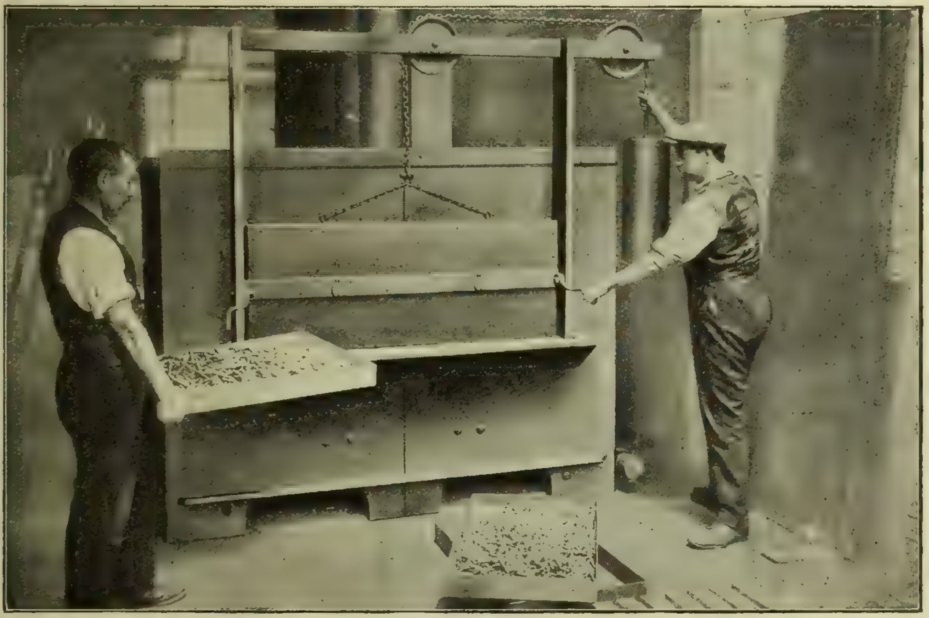
A point worthy of note is the complete absence of noise usually prevalent with gas and air blast furnaces, which is a matter at times worth consideration where a number of furnaces are working together in one shop.

The absence of cutting heats, which destroy brickwork and tiles, is another advantage, and means that the furnace lining will last much longer.

Gas and Air Blast.

The third type of furnace is that worked by gas and air blast. When only a small working chamber is required, and of insufficient dimensions to give heat from the brick linings to preheat air used for supporting combustion, then we revert to air blast. The use of gas and air blast furnaces may be limited to the tool room, for pre-heating and hardening of high-speed boring and planing tools, &c. In the case of a small twin-chambered blast-furnace for hardening the noses of planing and other lathe tools, the upper chamber is heated with the waste products of the lower; and the furnace will reach a white heat, starting from cold, in about 20 to 25 minutes, with a gas consumption of about 100 cubic feet per hour.

Another blast-oven furnace suitable for hardening milling cutters, taps, dies, &c., measures, internally, 18 in. by 15 in. by 9 in., and will in one hour heat up to 1300° C. to 1400° C., which temperature can be maintained for about 400 cubic feet of gas per hour. This furnace has a rectangular chamber cased with brickwork; the outer casing of the furnace being of wrought iron and castings, strongly braced together. The gas and air blast burners in this type of furnace enter at the top of the furnace. The action of the flame under the arch forms a quarter of a circle, and splits itself at the bottom of the furnace chamber. In this way the air-blast flame does not impinge on the work to be heated up. The furnace flues are constructed in such a manner that, whether the lifting door be opened or closed, it is possible to work with a reducing atmosphere, which is a most desirable condition when hardening high-speed steel.



RICHMOND'S NATURAL DRAUGHT REGENERATOR FURNACE FOR ANNEALING BRASS CARTRIDGE CASES.

The three classes of furnaces described—viz., natural draught, low-pressure gas and air, and gas and air blast—comprise the three principal types of modern gas-furnaces at the stage of development they have reached to-day.

[The lecturer showed on the screen a group of forty representative types of furnaces which indicated the progress that has been made in the practical application of gas-furnaces to almost every industry, and then proceeded to the main theme of the lecture.]

THE SERVICE OF GAS IN THE PRODUCTION OF MUNITIONS OF WAR.

At this critical time in our national history, those of us who are engaged in the gas industry are naturally gratified at the large extent to which gas is used in the production of armaments and ammunition in factories, shipyards, and Government works. It would hardly be too sweeping a statement to say that all the requirements of our Army and Navy are under tribute to gas in some way or other. Of my own personal knowledge, I know that the enormous output of war materials we have received from our manufacturers could not have been so rapidly made without the aid of industrial gas appliances, many of which, in their present economical and effective form, are of comparatively recent introduction. It is, I venture to claim, largely due to the service of industrial gas apparatus that our new armies were in a position to take the field much earlier than could otherwise have been the case.

Commencing then with the basic product. Manufactured steel, in bars, is sent out by the makers in an annealed condition; and for this purpose gas furnaces are being increasingly used. A slide shows two steel bar annealing furnaces. These are approximately 16 feet long, from which fact it will be obvious that they consume gas on a fairly large scale. Annealing in coal-furnaces necessitates packing the bars in a heavy cast-iron box to prevent the scaling of the steel. This box is considered by some to be unnecessary in the gas-furnace, in view of the uniform conditions under which gas-furnaces work. The elimination of the box naturally means less absorption of heat. Decreased labour is also an important factor—in short, gas annealing has been very economical. In many of the smaller steel works, where annealing is intermittent, the saving achieved by the use of gas-furnaces is something like 50 per cent. in the cost of fuel alone—a factor in works' economy which cannot be ignored by manufacturers in these days of keen competition.

The same operation can be carried out in a "L.P.G.A." furnace. This furnace will take a load of about 2½ tons, and will anneal carbon steel in bars at about 3000 cubic feet of gas per ton. The method is briefly as follows:

1.—The steel bar is charged into the cold furnace.
2.—The heating-up is accomplished in six hours, or thereabouts, with frequent thermometer readings.
3.—All dampers and secondary air nostrils are carefully closed, and the furnace and contents cooled down very slowly.

The following are figures from actual commercial working results in Sheffield:

Annealing Steel.

	L.P.G.A. Oven Furnace.	Natural Draught Regenerator Oven Furnace.
Weight of charge	6 tons	.. 1¾ tons
Total time of heating . . .	3 hrs.	.. 6 hrs.
Total time of cooling . . .	45 hrs.	.. 42 hrs.
Total time of operation . .	48 hrs.	.. 48 hrs.
Maximum temperature attained	850° C.	.. 850° C.
Gas consumption per ton of steel annealed	3000 cubic feet	.. 3600 cubic feet

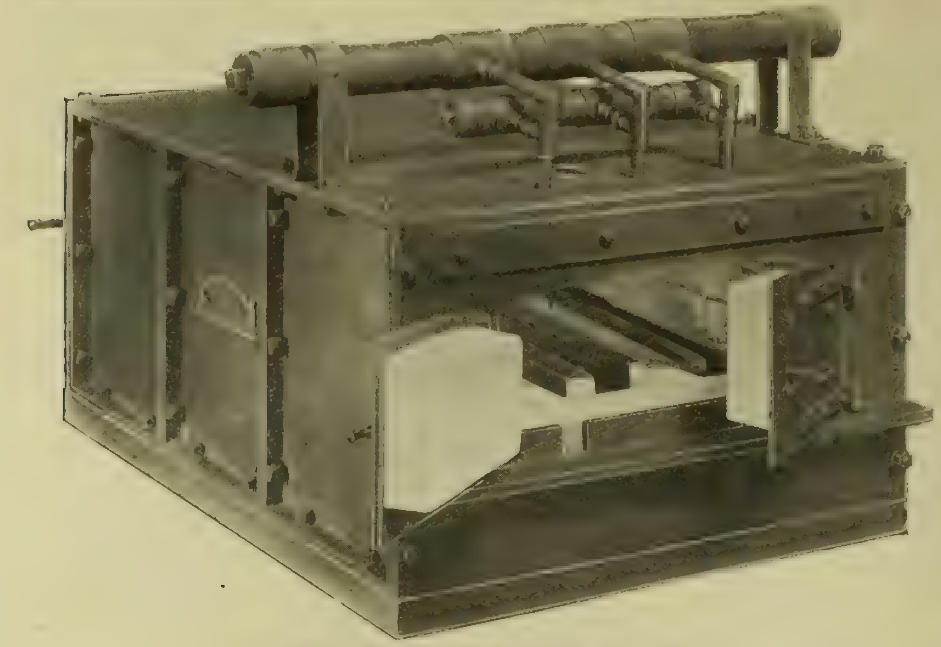
It will be seen from these figures that the "L.P.G.A." oven furnace worked with an economy in gas consumption of something like 20 per cent. less than the natural draught regenerator oven furnace.

Steel annealed in the "L.P.G.A." furnace is free from scale, and the annealing is, if anything, more uniform. This, in addition to the time and space saved, and (as already mentioned) the omission of the packing boxes, proves the superiority and economy in using town gas for this purpose to be established facts.

Steel billets for many purposes are also annealed or normalized in gas-furnaces. "L.P.G.A." furnaces have been found to be particularly well adapted to this purpose, on account of the strong floor before described, and the excellent conditions of annealing in a reducing atmosphere. This furnace will take a charge of 5 tons; and the process shown is that of normalizing, before rolling or forging, or other operations. Natural draught furnaces can be used for a similar purpose.

Furnaces Used in the Production of Shells.

From the steel bar and billet, we pass, naturally, to the all-important subject of shells. The heat treatment of shells—a



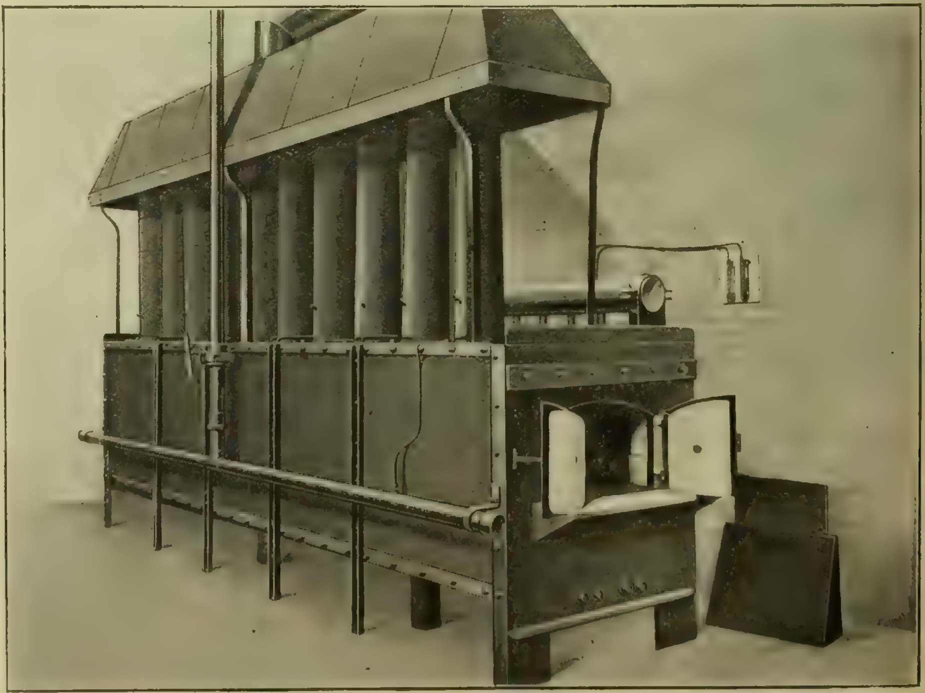
RICHMOND'S BLAST EXTRUDING FURNACE.

matter of vital interest to our national existence at the present moment—is largely carried out by the use of gas-furnaces; and the extension of their use in this direction is a matter of daily occurrence. Some of these furnaces are comparatively small; but even the largest shells are to-day being treated in this country in gas-furnaces. One of these furnaces measures inside 8 ft. 2 in. deep by 6 ft. 3 in. wide by 7 ft. high, and is capable of annealing or heat treating ten 15-inch armour-piercing shells at a time. The furnace is fitted with a lifting roof or arch; and the "L.P.G.A." system (as before described) is utilized here to advantage. This is one of the many large town-gas furnaces in use. There are over 10 tons of castings in the construction of the outer casing of this furnace. Large gas-heated furnaces are also in operation for oil-hardening these naval armour-piercing shells.

Reverting to the eighteen-pounder shrapnel shell, and the 4·5 and 6 inch high explosive shells, there are a very large number of furnaces in use for heating these two latter shells for the heading or nosing process; but it is no doubt generally known that this process is being discontinued in favour of screwing on a nose made from a drop forging. This, to some extent, eliminates the use of gas-furnaces for this particular process; but there are other operations in which gas-furnaces are almost indispensable.

Annealing Brass Cartridge Cases for Shells.

Having dealt with the "body" of the shell, gas oven-furnaces are also being used on a large scale for annealing the brass cartridge cases. A slide shows the first portion of an installation, illustrating four oven-furnaces, each 12 ft. by 4 ft. by 2 ft., for annealing 4·5-inch cartridge cases in trays. You will be aware that the cartridge made from a blank has to be annealed between each drawing operation, when it is necessary to have the oven evenly heated at a temperature of about 700° C. The type of furnace used is the natural-draught regenerative oven furnace previously described.



ANNEALING CARBON AND HIGH-SPEED STEEL IN RICHMOND'S "L.P.G.A." OVEN FURNACE.

Annealing Copper Bands Prior to Shrinking-on Shells.

The two previous operations do not exhaust the uses of gas in the production of shells. A large number of natural draught reverberatory furnaces are in commission for annealing the copper bands prior to shrinking-on. Some users specify gas with air blast to enable the operation to be carried out more rapidly; but from experience gained, and of sufficient time to verify, I have no hesitation in saying that the natural-draught reverberatory furnace will satisfy the most exigent requirements.

Drying Ovens.

Finally, in connection with shells, there is the drying oven and trolley. The former is heated with either luminous or bunsen flames placed around the bottom side of the oven, which is fitted with a double case through which the hot products pass. Trolleys of different shapes and dimensions are specially constructed to take the desired number of shells. The object of drying the shells is to harden the varnish placed in the interior, and this prevents any possibility of oxidation from the steel should the shell be kept in stock some time. This condition, however, is one not likely to be experienced, as we hope to "deliver the goods" with promptitude into the German lines.

Furnaces Used by the French for Bottling Shells.

Before passing from this subject, it will be interesting to describe the furnace used by the French and Belgian shell factories for "heading" the famous 75 mm. shells. It is strongly made, and the top part, which looks like a turret, revolves upon ball-bearings—the speed being completely under control. The turret revolves very slowly, and the heating capacity of the machine is 120 shells per hour. As the heating chamber is restricted, gas and air blast are used. A single and powerful burner plays on the bottom of the furnace from the top, and the hot gases find their exit from flues on the top of the furnace. When each hole contains a shell, by this heating arrangement the end of the shell only is heated, with the accuracy which is so essential a condition. This particular furnace is built in this country for our Allies.

From the subject of the heat treatment of shells, which is of absorbing interest, we come to another equally important branch of munition work—viz.:

FURNACES USED IN THE PRODUCTION OF SMALL ARMS.

Annealing Rifle Breeches.

The earlier method was to anneal these in boxes, packed with charcoal in a coal-fired furnace, or in coal-fired retorts or muffles. A specially designed reverberatory gas-furnace, with side guard tiles, is now in very extensive use in various small arms factories. The forgings are simply placed in the oven and piled-up to the side guard tiles, which keep them free from flame contact, by which means the annealing is carried out both with efficiency and economy.

Other component parts of rifles require to be case-hardened; and here again the gas oven-furnace is used in the same way as for case-hardening generally. The component parts are packed in boxes along with carburizing material, and the natural-draught furnace system proves quite satisfactory.

Hardening and Tempering Bayonets.

The rifle is incomplete without the bayonet; and in two operations at least connected with this weapon gas is being used. First, the hardening and tempering of the bayonet blade is carried out in two different types of furnaces. The hardening operation is achieved in a natural draught regenerative furnace, of oven or muffle type, in which the bayonets are brought up to the hardening temperature and quenched, after which they are placed in a metal oven which is regulated for tempering. The two operations have to be carried out with the greatest care; and a large proportion of the bayonets manufactured for small arms are dealt with in these gas-furnaces.

We have now described, very summarily, the heating operations through which the rifle and its bayonet pass. Then, naturally, comes the subject of the ammunition.

Cartridge Cases and Clips.

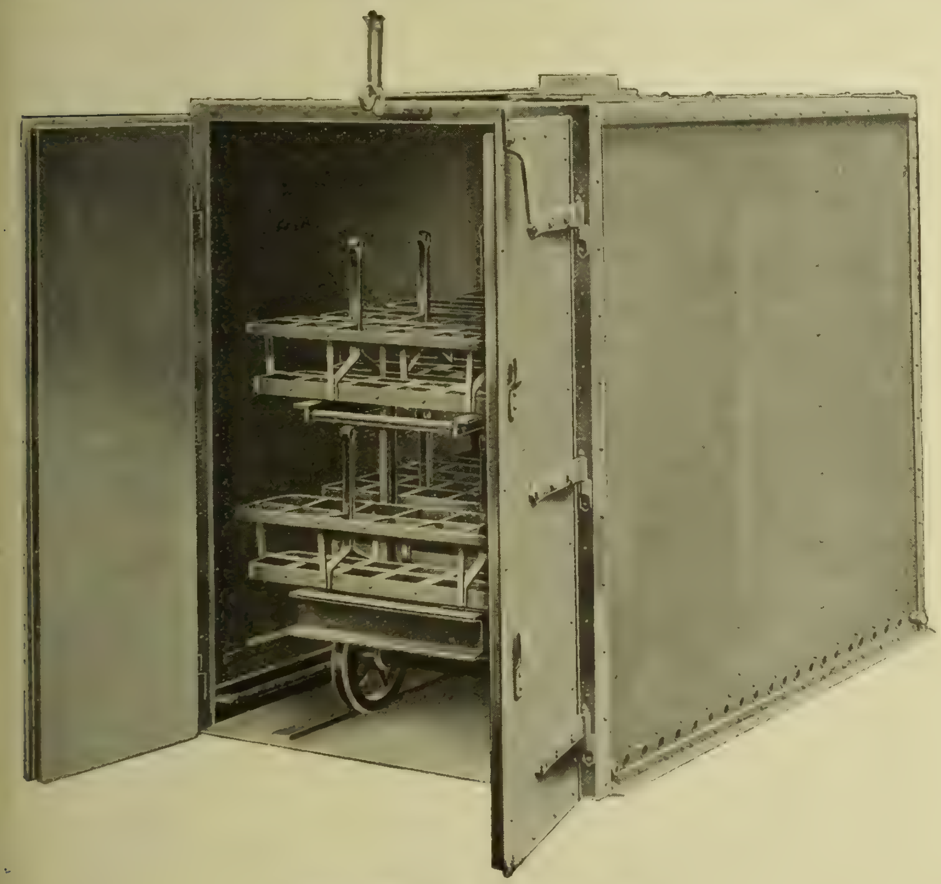
In two directions gas-furnaces are being largely used—viz., the annealing of the cartridge cases, and the tempering of the cartridge clips. For the first-mentioned operation, the cartridge cases are placed in pans, and annealed at a temperature of about 700° C. The second operation is the tempering of cartridge clips. These clips are made in huge quantities from thin steel, automatically pressed into shape. The operation is the tempering and colouring of these cartridge clips. Each furnace deals with about 10,000 clips per day, making an appreciable contribution to our stores of munitions.

Annealing and Hardening Barrels of Machine Guns.

We have all been highly interested in the revelations made by the Minister of Munitions in his recent speech regarding the subject of machine guns. It is only too apparent the reliance which the enemy has placed upon his preparations in this arm; and it is pleasing to feel that in our national efforts to overtake his superiority gas has played a not inconspicuous part.

Furnaces Used in Manufacturing Aëroplanes.

If there is one branch of military and naval work on which there is particular reason to congratulate ourselves, it is, I suppose, our magnificent air service. The development which has been made so rapidly from small beginnings, and the ascendency gained over the enemy by our intrepid and skilful pilots, are both phenomenal. Here, again, in the construction of the aëroplane, gas has earned its badge "on war service."



RICHMOND'S SHELL-DRYING OVEN.

The oven-furnaces before described are used for the thermo-treatment of motor gears and constructional pieces which have to be carried out with a maximum of accuracy. The great need of this will be quite understood, as each component part of an aëroplane, whether it be the gearing of the motor or the joint pieces, the wire streamers for bracing-up the structure, all require the utmost exactitude in their thermo-treatment, within a few degrees centigrade. I would call attentien to an interesting lead bath for annealing wire streamers in molten lead. It is a furnace 6 feet long, which is heated with down-draught burners and secondary air supplies for preheating the air. These furnaces have proved very successful; and lengths up to 15 feet and more are now in daily use for this operation in several aircraft factories.

Gas-furnaces are also used on a large scale for the heat treatment of nearly all the component parts of the structure. In such important instruments of warfare and of delicate adjustment, every part is naturally subjected to the most careful inspection after the heat treatment before it is allowed to be incorporated in the machine; and it is no mean tribute to the reliability of gas-furnaces that the results should have given entire satisfaction.

Armoured Cars.

Closely allied, I believe, to the Naval Air Service, is the armoured car branch. Gas oven-furnaces of the "L.P.G.A." type are extensively used for the heat treatment of nickel steel and other kinds of steel. To secure the highest bullet-proof conditions compatible with lightness, careful and precise treatment is necessary; and gas-furnaces, with their perfect control of temperatures and their constant and unvarying heats, have been ideal for this purpose.

Motor Transport.

Not only for the armoured car, but for all motor-cars for the Army Service Corps, general transport, &c., gas-furnaces are in requisition. One of the slides illustrates part of the hardening shop of an important motor and engineering works associated with a famous armament company. All the furnaces use gas as fuel; and since the war started, additional ones have been installed, greatly assisting the output of gear parts, &c. The principal work of this shop is the thermo-treatment of gear parts.

Some motor factories heat-treat cam-shafts in oven-furnaces; but a good deal of skill is required in getting them perfectly horizontal, besides which one has to consider that only certain parts of the shaft are hardened, other parts being left soft and tough. In order to carry out this operation, some clever devices have been thought out. When packing into boxes filled with carburizing material, the part of the shaft which is not to absorb carbon is covered with clay; or, again, other motor works have an electric copper bath for depositing copper on such parts of the cam shaft as do not require to be case-hardened with the carburizing material before referred to. Further, in order to avoid warping, which, of course, is only overcome by the most skilful handling in horizontal oven-furnaces, vertical furnaces have been designed for this operation on the lines described.

Another important component of the motor gear engine is the magneto. Hitherto, we depended on Germany almost exclusively for the production of magnet steel; but, since the war, British steel makers have directed their attention to its manufacture. Here, again, the gas-heated oven, or muffle furnace, is used with great advantage for exact heat treatment.

Furnaces for Accessories Necessary to the Production of War Munitions.

I have now given you a few particulars of furnaces used in the production of ordnance and other war material, and, finally, we come to the tool-room requirements—*i.e.*, the production of such tools as milling cutters, reamers, planers, slotters, taps and dies, &c., which have been increased greatly to cope with the enormous production of ordnance. It is very important to have suitable furnaces for the thermo-treatment of such high-speed tools. It will be realized how very necessary it is to heat-up any high-speed tool gradually, before it reaches the hardening temperature—somewhere about 1300° C.

In order to achieve hardening under the best conditions, two furnaces are recommended for the purpose—viz., a natural-draught furnace, in which the tool is heated-up to a matter of 900° C. or thereabout, and rapidly finished in a second furnace, which is held at a temperature of about 1300° C. In this way the tool is thoroughly annealed before subjecting it to the higher temperature furnace; and as the completion of the heating operation to the required temperature is very rapidly achieved in the second furnace, damage to the tool—viz., decarburization of its surface—is obviated.

Some high-speed furnaces are made in twin form—the lower chamber at a high temperature, the upper chamber at a lower temperature for preheating. But the two furnaces for high speed, as before described, are preferable, because the annealing operation with the lower temperature furnace can be better and more regularly carried out, while the finishing operation in a single-oven furnace is better, because this oven can be so adjusted as to exclude the entrance of any cold air. In fact, the flue of this furnace may be operated through the working door; and under such conditions all air is expelled from the working chamber of the furnace.

For hardening planers—another tool of which noses only have to be hardened—a small furnace of the twin form is quite satisfactory. The preheating chamber is above the finishing chamber. This little furnace will heat up to 1300° or 1400° C. in about twenty minutes, starting from cold.

Copper, brass, and other alloy metals are, of course, largely in demand for the manufacture of munitions—viz., cartridge cases, shell fuses, &c.—and a good deal of extruded metal is used for the production of fuses. Brass or copper billets are heated-up in a gas-furnace prior to being placed in the press. The ingots, having a round section, are charged in the cooler end of the furnace, and work down gradually to the hot end, whence they are withdrawn one by one.

NEW SOUTH WALES AND QUEENSLAND GAS INSTITUTE.

Presidential Address of Mr. T. O. Morland, of the North Shore (Sydney) Gas-Works.

The First Annual General Meeting of the New South Wales and Queensland Gas Institute, was [as recorded on p. 596 of the "JOURNAL" for Dec. 14] held in Sydney, on Oct. 26, when Mr. T. O. MORLAND, the Manager of the North Shore (Sydney) Gas Company, the President, delivered the following Inaugural Address.

It is hardly necessary for me to say anything to-day in support of our action in founding the Institute. The fact that so many kindred Associations exist throughout the world, all of them doing useful work, is quite sufficient to justify us in our action. But I think it is desirable at this, our first annual meeting, to briefly put on record the present position of the industry, and its rate of progress in the two States of the Commonwealth from which our membership is drawn.

GROWTH IN NEW SOUTH WALES AND QUEENSLAND.

The most reliable statistics available show that during the last eight years there has been a steady growth in the number and capacity of the gas-works erected, and in the number of consumers receiving gas from them. I find that in New South Wales in 1907 there were 35 works, 16 of them owned by companies, one by Government, and 19 by municipalities. The output of gas was 2,777,936,000 cubic feet, and the number of consumers 100,542. The average output per consumer was 27,579 cubic feet.

In 1914 there were in New South Wales 45 works—an increase of ten—23 of them being the property of companies, one was owned by Government, and 21 by municipalities. The output of gas had increased to 4,674,850,000 cubic feet, equal to a gain of 68·5 per cent., and the number of consumers to 152,872, equal to 52·03 per cent.; while the average output per consumer was 30,580 cubic feet.

In Queensland there were in 1907 fifteen works, all owned by companies. The output of gas was 372,058,000 cubic feet; the number of consumers was 13,427; and the output per consumer was 27,709 cubic feet. In 1914 the number of works was sixteen, an increase of one only; but the output had grown to 745,530,000 cubic feet, equal to 100·3 per cent. increase, and the number of consumers to 27,564, equal to 105·2 per cent. The output per consumer averaged 27,047 cubic feet, a slight decrease when compared with 1907.

These figures show that the gas industry, in spite of the competition it has to encounter, is not decaying, as some think, but on the contrary is prospering. It flourishes not only in our part of the world; for in Britain and in her other Colonies and Possessions the gas industry is in an equally satisfactory condition. At no time in its history has its importance to the Empire been more strikingly exemplified than at the present; for without gas and some of the bye-products of coal, we should not possess in sufficient quantity the high explosives now so urgently needed for our defence.

COAL.

At a meeting of persons interested in making and distributing gas, coal is a subject which must occupy a prominent place in their thoughts. Fortunately for New South Wales, the great coal-fields which find the outlet for their products at Newcastle furnish an article which can be equalled in few parts of the world. Unfortunately, however, in Australia, as in many other countries, the business of hewing coal is one that is subject to many interruptions, owing to labour disputes. A general strike, during which almost the whole of the supply of coal in this State was shut off for eighteen weeks, occurred a few years ago; and other strikes of a more or less local character are not infrequent. Managers of gas-works should therefore make such provision as will enable them to tide-over periods when suitable coal is either unobtainable or obtainable only at a greatly increased cost.

The North Shore Gas Company keep, in addition to the coal delivered into the stores, a reserve stock of large coal in the yard; and though this coal is not under cover, I have no reason to believe that the exposure has caused any serious deterioration in its gas-yielding properties. The cost of keeping locked-up the capital which the coal represents is not insignificant; but when the inevitable strike comes, the expenditure is well repaid.

Like most other articles used in gas-works, coal has greatly risen in price; and the present labour unrest makes a further rise appear not improbable. We are now paying about 50 per cent. more for coal than we paid eight years ago. Labour, also, is more expensive; and though labour-saving appliances have been installed in the works, the cost of making and distributing gas has risen during this time by about 50 per cent.

NEUTRAL BAY WORKS.

At these works, part of the coal is carbonized in horizontal retorts, some of which are hand-charged and drawn, others being charged and discharged by means of a De Brouwer complete stoker. The bulk of the coal is, however, carbonized in inclined retorts. We have twenty beds of the latter, with seven retorts per bed. The furnaces are of the regenerative type. A De Brouwer hot-coke conveyor and an elevator are used in connection with the inclines. By this means, the coke is removed from the retort-house and deposited in bins in the yard. From these it is loaded into bags, or, if required, into carts in bulk.

A special feature of the coal-store adjoining the inclined retort-house is the height at which it has been built, in relation to the retorts. The inclines have been erected at the foot of a cliff rising about 50 feet above the ground-floor level. On this cliff, the coal-store has been built. Coal is delivered alongside the works jetty, by water carriage. It is discharged from the ships in baskets, and is afterwards taken to store by means of trucks and push-plate conveyors, passing through coal-breakers *en route*. It can also be weighed, if desired. Under the store, subways and shoots have been constructed. Through the latter the coal required for the retorts is drawn from the bottom of the store into trucks, and removed to the retort feeding hoppers, into which it is easily tipped. This peculiarity in the design of the store enables a larger stock of broken coal to be kept in it than would be prudent if there were no openings in the bottom. By withdrawing coal daily from each shoot in rotation, the temperature of the mass is ascertained; and if any portion of it is found to have heated unduly, this can be speedily removed to the feeding hoppers.

Chiefly with the object of profitably disposing of our coke, we have installed a carburetted water-gas plant capable of making 500,000 cubic feet daily. During the late strike at some of the Maitland coal mines—entered upon for the purpose of bringing about the abolition of the afternoon shift—we found this plant particularly useful. The mine from which we now obtain our coal was one of those affected, and remained closed for about ten months. When the strike began, we fortunately had a large stock of coke in the yard; and with the aid of this, and a quantity of oil, we were able to keep up the supply of gas without the loss which otherwise we should have sustained. The coal gas and the carburetted water gas mix before passing through the exhausters to the condensers.

NAPHTHALENE AND REVERSIBLE CONDENSERS.

These latter are of the reversible current slow-speed type. They are air-cooled, but protected from the sun's rays by a louvred shade. For several years prior to the erection of the first reversible condenser, we were receiving numerous complaints of stoppages in the service pipes, due to deposits of naphthalene. Though the quantity of gas sent out at that time was only about one-sixth of the present output, consumers' complaints from this cause sometimes amounted to over 200 per week. In the works, we were in a worse plight than outside; for the connections leading to the purifiers, the station-meter, and the gasholder were at times almost choked with naphthalene, which had to be removed from them fortnightly.

With the object of finding a remedy, I searched through all the available literature on the subject, and made preparations for the introduction of a kerosene vaporizing arrangement similar to that first used by Messrs. Botley, at Hastings. About the beginning of 1902, I read of Mr. Carpenter's experience with a reversible condenser at the Bankside works of the South Metropolitan Gas Company. I determined to instal one constructed on this principle, in the hope that it would afford us some relief. It was erected in 1903, and was a complete success, for naphthalene gradually disappeared from the works, as well as from the consumers' services and meters.

The condenser is made of cast iron, and consists of a number of lengths of 18-inch by 12-inch branch pipes bolted together, and laid so that the branches point upwards. There are four rows of pipes. Into each of the branches a double length of 12-inch pipe is fixed. These 12-inch pipes are connected at the upper end by almost similar branch pipes to those at the bottom, but made with spigot ends, so as to fit into the sockets of the 12-inch vertical pipes. The first and second rows of pipes are joined at the top by a breeches-pipe; the third and fourth being similarly connected. The inlet is provided with a four-way valve, and the course of the entering gas can be diverted as desired into either side of the condenser.

The gas is first carried to the top, and passes downward through two rows of pipes, then upward through the remaining two rows. Water can be used on the condenser, if desired; but we have so far found cooling by this method unnecessary. The temperature of the atmosphere has hitherto, if the apparatus is not overworked, been sufficient to produce satisfactory results. When the condenser is in use, any naphthalene which the gas may contain is lodged in the pipes through which it rises; and when the current is reversed, the hot hydrocarbon vapours dissolve and carry with them to the tar-tank any naphthalene adhering to the sides of the condenser. The current is reversed twice weekly.

When this condenser was erected, its cooling area, inclusive of the pipes between the inlet and the retort-house, was about 30 square feet per 1000 cubic feet of gas made per 24 hours. But with the increased output of gas, the proportion was gradually diminished; and during the winter of 1911, when the cooling area was 10 square feet per 1000 cubic feet per day, we again noticed deposits of naphthalene in the works—particularly on the purifier covers and on the oxide of iron in the boxes, though not to the same extent as in 1902. We therefore determined to erect an additional condenser of similar design, though we did not anticipate that the conditions existing then were contributing to the trouble which afterwards eventuated.

About the beginning of 1911 a few stoppages in the service-pipes were again reported. At Christmas we had a spell of particularly hot weather; the thermometer registering in the shade sometimes over 100° Fahr. The number of complaints of poor supply increased rapidly, until on one day—Jan. 8, 1912—they amounted to 109. Naphthalene was found in the services; but by far the greater number of stoppages were due to the spouts of the meters becoming blocked with it. At this time the additional condenser of which I have spoken was nearing completion; and we were able to bring it into use in February, 1912. During the following winter, our condensing area per 1000 cubic feet per day was 17 square feet. I am pleased to be able to tell you that we have enjoyed since then a period of freedom from this most troublesome bye-product.

As a result of my experience, I have arrived at the conclusion that, if coal is carbonized in horizontal or inclined retorts at the temperatures now employed, 10 square feet per 1000 cubic feet of gas per 24 hours is an insufficient area for atmospheric condensing. I think that from 12 to 15 square feet per 1000 cubic feet per day should be allowed, and that the condenser should be so arranged that the current of gas can be reversed. I am satisfied that the naphthalene which gives so much trouble in the warm months of the year is made and deposited in the mains during the winter. When the temperature of the summer gas is sufficiently raised, this naphthalene is taken up by it and carried forward to the services and meters, where it is again deposited.

I estimate that it costs 2s. for labour in attending to every complaint caused by naphthalene, and that another 2s. is lost owing to the diminished consumption of gas between the time when the obstruction began to interfere with the gas supply and its removal. The loss to gas companies caused by naphthalene deposits, and the inconvenience and annoyance to consumers, are so great that every effort should be made to abate this nuisance.

PURIFIERS.

Our purifiers are of the dry-lute kind. The joints between the covers and the boxes are made with hemp gaskets soaked in a hot mixture of white lead and tallow. The grids on the lower tier of the T-steel bearers are of the ordinary pattern; but the others consist of single wooden bars ▽ shaped in section, and placed at distances of about 7 inches apart centre to centre on the remaining bearers. We find that, if the oxide is supported in this way, it is kept sufficiently open to enable the boxes to be filled in one layer to within 9 inches of the roof, without causing undue back-pressure. The work of emptying them is easy, when compared with that required in purifiers fitted with grids of the hurdle type. Replacements of the V-shaped bars are not so frequent, but when required are easily and cheaply made.

RESIDUALS.

The disposal of residuals is a subject requiring constant attention. When the production is in excess of the demand, coke (a bulky bye-product) causes inconvenience in the works, and great expense in stacking. Our carburetted water-gas plant has relieved us, to a large extent, of this difficulty; and we are now able to dispose of our surplus coke almost as soon as it is made. Our ammoniacal liquor is sold to a company who manufacture anhydrous ammonia from it. Formerly we converted our gas liquor into sulphate of ammonia on the works. Tar has, of late, been in good demand in Australia, where in summer the heat drys up and makes the macadam roads easily broken by the traffic. Nothing keeps them in such good condition as a few coats of coal tar, sprinkled when hot over the surface; for the hotter the weather, the more elastic the road becomes. Some of the municipalities on our side of the harbour find that by adopting this practice they save large amounts yearly.

COMPETITION AND ELECTRICITY.

As you probably know, we shall soon have opposition from the Sydney City Council, who are now erecting poles and wires for lighting with electricity the four municipalities on the North Shore. We shall probably lose some customers who light by gas, or who would have done so if electricity were not available; but I do not anticipate that electricity will very materially reduce the volume of our business. A short time ago a customer who had installed the electric light in his residence complained that, though gas was not now used by him for lighting to the same extent as formerly, his gas bill was in excess of the corresponding quarter of the previous year. I found this statement to be correct. In the New South Wales "Industrial Gazette" for September, I learn that a gas consumer lodged a similar complaint with the Government gas examiner; and this officer, after investigation, reported that the amount of gas charged for had been consumed. The fact is that the quantity of gas used in domestic lighting is small when compared with that consumed in cooking and heating. The comparatively small cost of lighting by gas was responsible for these complaints.

Electricity has the disadvantage that, when compared with gas as an illuminant, it costs nearly twice as much, and when used for cooking or heating three-and-a-half times as much. In arriving at these results, I have taken the prices now ruling in Sydney for electricity and gas respectively.

SHOW-ROOM.

At North Shore we are prepared to meet the coming competition. In the offices recently erected, we have a show-room which faces the street, where we exhibit and sell all the most approved appliances for lighting, heating, and cooking. The room is brilliantly illuminated from dusk to 10 p.m. every evening by inverted incandescent lamps hung outside and lit and extinguished by clockwork. On the first floor of our office there is now being constructed a model dwelling, planned by our Secretary. This comprises all the necessary rooms, from the laundry to the drawing-room, and is fitted up with gas heating, cooking, and lighting appliances of the most up-to-date kind. In connection with this exhibition, we have recently engaged a lady lecturer; and when the arrangements are complete, we purpose giving lectures and demonstrations in cooking.

OYSTER COVE WORKS.

At Oyster Cove, where additional works are now being erected by the North Shore Gas Company, many natural difficulties have had to be overcome. Considerable sums have been spent in reclamation, in diverting a water-course running through the property, in excavating and filling in, and in road making. We hope, however, to effect some economies there by improved methods of handling material, and in carbonizing. At our new works, we purpose discharging the colliers by electric cranes and grabs, instead of by baskets or buckets. The cranes will deliver the coal into breakers, through which it will pass to a gravity bucket conveyor and elevator. It will be raised by the latter to a height of 90 feet, and deposited in the coal-store. As at the Neutral Bay works, the coal will be drawn from the store through openings in the bottom. But the Oyster Cove store will be twice the width of that at Neutral Bay—viz., 100 feet.

VERTICAL RETORTS.

The retorts are Glover-West continuous verticals. The bench will contain ten settings of eights. The coke from the retorts will discharge into a De Brouwer hot-coke conveyor, by which, and by an elevator, it will be removed to, and deposited in, bins at the end of the retort-house. There are two bins; one to receive the coke for the furnaces, the other the coke for sale.

A carburetted water-gas plant capable of producing 500,000 cubic feet per day has been erected. The coke for this will be delivered by the elevator into trucks; and after crossing a bridge 40 feet above the yard level, it will be delivered into the feed-hopper in the carburetted water-gas house. Coke which cannot be stored in the bins will be removed by a telpher and stacked in the yard. The telpher can also be employed in storing, in the open, a reserve stock of coal. The section of the works now being erected will have a capacity of $2\frac{3}{4}$ million cubic feet per day; but there is room on the site for a plant able to produce nearly $7\frac{1}{2}$ million cubic feet per day.

INDUSTRIAL LEGISLATION.

The industrial laws under which we are now working, and the conditions which have come into existence since they were enacted, bear very hardly on most employers of labour. But the gas industry is, in my opinion, more adversely affected by them than any other. In the event of a dispute with our men, we cannot close our works without causing great inconvenience to the large number of people who now require gas for domestic purposes. A strike at the gas-works also generally brings about a cessation of work in many factories where gas is used either to produce power or in some manufacturing process.

Industrial agreements may be entered into with the employees as to the quantity of work to be done, and Wages Boards may determine the wage to be paid; but none of these has so far been sufficient to ensure more than short periods of peace. If the agreement does not suit, it is broken. If the wage is not thought to be enough, more is asked for, and if not granted a strike is threatened. In addition to these serious troubles, disputes of a minor character are of almost daily occurrence. Conferences with the union secretary and attendances at meetings of Wages Boards are now becoming so numerous that in works employing (say) 1000 men, the time of an officer could be fully occupied in dealing with them, or in getting ready to deal with others which he knows will shortly arise.

Parliament has, perhaps, not improperly placed certain restrictions on gas companies. Could it not also impose on the employees conditions which would ensure the protection that the public so much need? This is a matter that has, so far, not apparently engaged the attention of our Legislature, but which I feel certain must eventually force itself upon them.

TWO-AND-A-HALF YEARS' WORKING EXPERIENCE WITH CONTINUOUS VERTICALS.

By J. Mackenzie, of Newcastle (N.S.W.).

[A Paper read before the New South Wales and Queensland Gas Institute, Oct. 26, 1915.]

At the request of the President, I have pleasure in contributing a few notes which may prove of general interest to members, and, I hope, helpful to some who may be in the position of having to decide the important question of extensions to their carbonizing plant. My Company were the first in Australia to bring into use an installation of continuous vertical retorts; and we therefore had the honour of first working through the difficulties which may be said to always follow the adoption of an entirely new system such as this.

Our system is the Glover-West. We have four double benches of eight retorts each, a total of 32 retorts. Each bench is heated by a producer, whose gas-outlet can be made to heat eight retorts or only four retorts, as required. This is found an economical arrangement as regards fuel, when not more than four retorts in a particular bench are needed.

The coal is received by rail in hopper-waggons on the Company's gravity sidings, where they are moved as required over a large underground hopper, and the doors struck. The coal gravitates to a breaker, and is then taken by a bucket elevator either into the coal-store or direct up to the continuous hoppers which are fixed immediately over the retorts. A lift is provided for raising the coke in hopper-barrows to the producer floor for feeding the producers. The coke falls from the retorts, and is removed by a drag-bar conveyor moving in a trough and fixed in the floor directly under the retorts. The coke is discharged from the drag-bar at the end of the retort-house into a bucket elevator, which carries it up to a set of three overhead hoppers, where it is screened and classified.

For the whole of the operations, which embrace the journey of the raw coal from the waggon through the retorts till the coke is dropped into sacks from the coke-hoppers, no man-handling is required beyond opening a door or moving a lever—electric power being exclusively used—direct current at 220 volts. The motors are all totally enclosed and dust-proof.

The success or otherwise of the continuous vertical system very largely depends upon the unhindered and unimpeded action of gravity, from the time the raw coal enters the top of the retort until it is extracted as coke into the chamber at the bottom; for should this law be interfered with in any particular retort, gas making will cease in time in that retort until the trouble is removed. This trouble is called "hanging-up," and may emanate from two causes—namely, excessive swelling of the coal in the retort, or irregular growth of carbon in the retort.

In the early days of working, we had trouble from the first cause when using Borehole coal. This coal, when put into the retort, expands greatly; and the coke at times packs so densely at the bottom of the retort that the extractor cannot break it off, but works a face on it, and so the regular descent of the charge is arrested. Apart from frequent stoppages, the carbonizing of a coal like this by itself is necessarily slow, and consequently the output of the retorts is less than it would be if the uninterrupted passage of the coal through the retorts was going on freely. By mixing a small proportion of Maitland coal with the Borehole, the former appears to keep the coke in the retort in a more loose state; and this has been found to work very satisfactorily. The second cause of "hanging-up" is due to a retort having run too long before the carbon is stripped off; and irregular patches of carbon obviously hinder the free passage of the charge through the retort. The remedy for this is not to wait until the trouble actually occurs, but to anticipate it. It is best to have a table drawn up, showing the number of days the retorts have run and when each retort is due for cleaning, so that each retort comes off, is cleaned, and put on again automatically, as it were.

Scurfing is carried out by first emptying the retort and opening the sight-hole on the coke-chamber, and removing the ball at the top of the retort. A strong upward current of air is thus set up, which soon loosens and burns off the carbon, which drops off, or may be easily stripped off with long light bars from above. It is noticeable that there is proportionately less carbon removed from verticals than horizontals, which, I think, is accounted for by so much of it being actually burnt-off by the strong current of air mentioned. Not the least important part of scurfing is to chip off all carbonaceous matter from the inside of the coke-chamber, so that the worm will work freely at least until the retort is again due for cleaning.

The heating of the retorts is a most important factor tending to successful working; and the author has found it advantageous to train a man specially to attend to this work, who understands the principles of combustion, the adjustments of primary and secondary air supplies, and the general "why and wherefore" of maintaining regular and constant heats. This man spends about an hour each morning examining the flues and heats and adjusting, after which he goes on to other work. It pays to fire-clay wash the fronts of the settings periodically, to prevent stray air getting drawn into the flues. It is also advantageous to now and again test the gases leaving the main flues, to see that there is no waste going on. The author has installed a "CO_2 Recorder," which can be easily connected to any of the four main exit-flues as desired. This machine, along with the recording calorimeter, is fixed in a dust-proof case in the retort-house, and under the observation of the operators.

A matter which gave considerable trouble in the early days of working was a growth of tough, sticky clinker up the sides of the producers and beyond the reach of bars from below. About once a fortnight the clinker got so bad that it was necessary to allow the fire to get low down in the producer. Then the clinker was chipped off by means of bars through the charging-door below. This operation took up a considerable time, and was very hot, arduous work. It can be well understood that it did not do the settings any good. Not only was producer gas stopped entirely while the cleaning was going on, but cold air was drawn in, and the heats rapidly fell back until the fire was rekindled and the producer again brought into action. This trouble has been largely overcome by injecting steam all around and under the fire-bars along with the primary air. The steam has the effect of minimizing the upward growth of clinker, and renders it rotten and friable; and it can be easily broken off by bars from below.

Another matter which has given, and is still giving, trouble is a pitchy deposit in the collecting main, which, if not regularly cleaned out, would soon entirely block-up the main. The author has traced this trouble back to the overheating of the crude gas immediately on issuing from the retort, and is of opinion that it cannot be entirely overcome, having regard to the efficient heating of the tops of the retorts, except by considerable alteration to the top mouthpiece and off-take pipe. The trouble may be minimized, however, by preventing radiation in every way possible from the brickwork to the mouthpiece.

Though these retorts are described as continuous, the production of gas is largely in intermittent rushes. At each turn of the extractor-worm, which causes a quantity of coke to leave the retort proper, and a corresponding quantity of coal to take its place, there is a sudden evolution of gas; and as this happens simultaneously on all the retorts in action on one side of the retort-house, the pressure backs-up rapidly on the retort-house governor, and a quick response is requisite from this apparatus. The author has found it necessary to maintain a pull of 20-10ths on the inlet side of the governor, in order that it may be quicker to respond to these sudden rushes of gas. A different form of valve on the governor, however, appears to be required, in order to get perfect results under vertical retort conditions.

As regards the labour required for operating this installation, two men on each shift do the work up to the full number of 32 retorts which includes starting and stopping the necessary motors, discharging coke from the retorts to the conveyors, filling the producers with coke, pricking-down coal from around the tops of the retorts and charging the intermediate hoppers, and pricking the producer-fires and cleaning out the ashpans. Any retorts "hung-up" have also to be got to work by these men.

The fires run 48 hours before cleaning, and one is cleaned every other day; and this and scurfing are performed by other men. One man is employed from four to six hours each day six days a week removing pitch from the collecting main. A greaser is also employed every day to attend to the lubrication of the extractors, motors, and the coal and coke handling plant.

To sum up the experience gained in the working of these retorts, the author can testify to the immense improvement over horizontal retorts with the old-fashioned direct fires, which this system replaced. The advantages in our case may be briefly stated as: (1) Large saving in labour. (2) Increased yield of gas. (3) Great improvement in working conditions for the men.

Those who are considering the adoption of these retorts, however, the author would especially advise to carefully weigh with these advantages the following: (1) The coke is different. It is harder, and has all volatile matter removed. (2) The tar is much thinner, and contains more light oil. These are important considerations, where a good steady sale for coke and tar have been established under horizontal conditions, so to speak. As soon as the same residuals, but made under vertical conditions, come to be used by the same people, complaints will probably ensue. If the coke, for example, is sold mostly for domestic use, it will probably be found that it requires more draught than formerly, or that a different type of grate is required to properly consume it. The author also has found that the tar from verticals, before it is at all suitable for road-making purposes, must be denuded of its water and light oils.

In large units always fully employed the saving in labour is very considerable, as has already been pointed out, and outweighs any disadvantages in the changed conditions of coke and tar. When, however, the unit is less than one million feet per day, the saving in labour decreases proportionately, as the same number of men who make half-a-million feet can also make twice the quantity. In other words, and assuming that one man's work per shift is limited to sixteen retorts heated by two fires, this would produce on an average 480,000 cubic feet per day. When more gas is required beyond this quantity, no matter how small, it will be necessary to employ one man extra on each shift; so that their work and the quantity of gas they produce will be quite out of all proportion to what the other men are doing up to a certain point. These are important matters to consider where the unit is intended to be a small one, and not always fully employed.

In order to get over this disproportion in having to employ extra men to make a relatively small quantity of gas, the author has installed a carburetted water-gas plant, which it is intended to bring into use only when immediately required, and keep the number of retorts at work constantly, and at nearly the maximum number the men can work. This, it is hoped, will obviate the necessity of having to keep men who are not fully employed all day, though fully paid for the day.

As regards the appearance of the retorts to-day, all the author can say is that they still look in excellent condition; but it is impossible to tell yet what their life will reach to—certainly much longer than the old horizontals. The only important repairs so far found necessary has been the relining of one producer just above the fire-bars.

American Gas Institute Meeting for 1916.—It has been decided that this year's meeting of the American Gas Institute shall be held in Chicago on Oct. 17, 18, and 19.

SWISS TESTS OF GAS-FIRES.

By Dr. E. Ott, of Zürich.

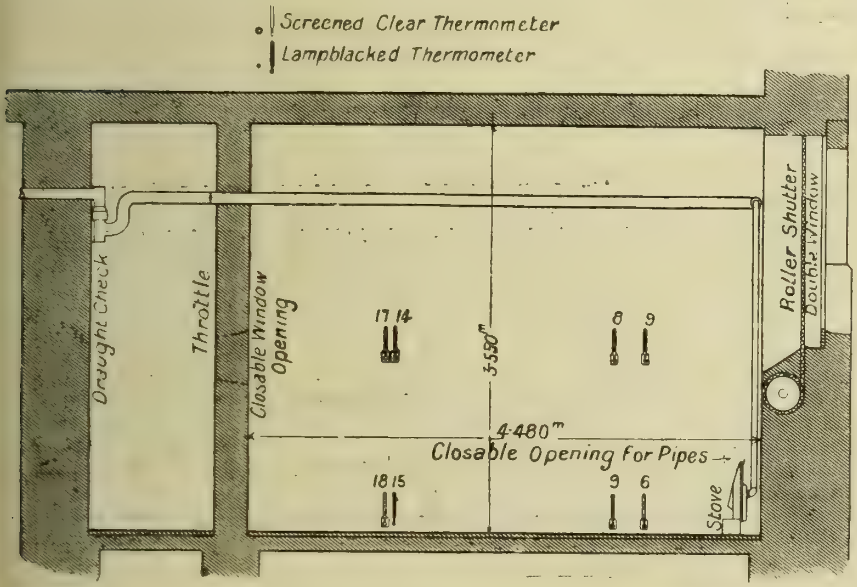
Contributed by Dr. E. Ott to the "Journal für Gasbeleuchtung" of Nov. 6 and 13, was an account of investigations carried out by him in the laboratory at the Schlieren works of the Zürich gas undertaking, on the efficiency of different types of gas-fires. The following is an abbreviated translation of the contents of Dr. Ott's articles.

The investigation extends to gas-heating apparatus which acts mainly by convection, as well as that which acts mainly by radiation, because both types have some special advantages which are rightly appreciated by the public. The hygienic aspect of the question whether heating by convection is preferable to heating by radiation is not discussed by the author, as he regards it as a question to be settled by authorities on hygiene. The satisfactory character of a fire depends primarily on the heating efficiency—*i.e.*, that while the calls upon it vary, it furnishes as much heat as possible to the room which is being warmed, and allows as little as possible to escape with the chimney gases. Any deficiency it may have in this respect, however, may be compensated by better and more rapid utilization of the rest of the heat. But there are also other considerations in judging the satisfactory character of a gas-fire, among which may be mentioned that, in normal working, it should allow no products of combustion to escape into the room; that down-draught in the chimney should not damp or extinguish the flames; that there should be as little opportunity as possible for the settling of dust, which causes a bad smell when the fire is in use; that the fire should act properly and without risk of the burners lighting-back when the consumption is reduced to at least one-third the normal; and that the fire should be solidly and well constructed. Special attention was given to the measurement of radiation, because hitherto comparatively few investigations of it have been made. The rise of temperature at different points in the room was also specially studied. It was considered that only fires of the same size—viz., consuming when fully turned on, 25 to 26·5 cubic feet per hour—should be compared with one another; that the proper pressure of the gas at the burner should be 16·10ths to 20·10ths; and that the middle of the flames should in all cases be about 12 inches from the floor.

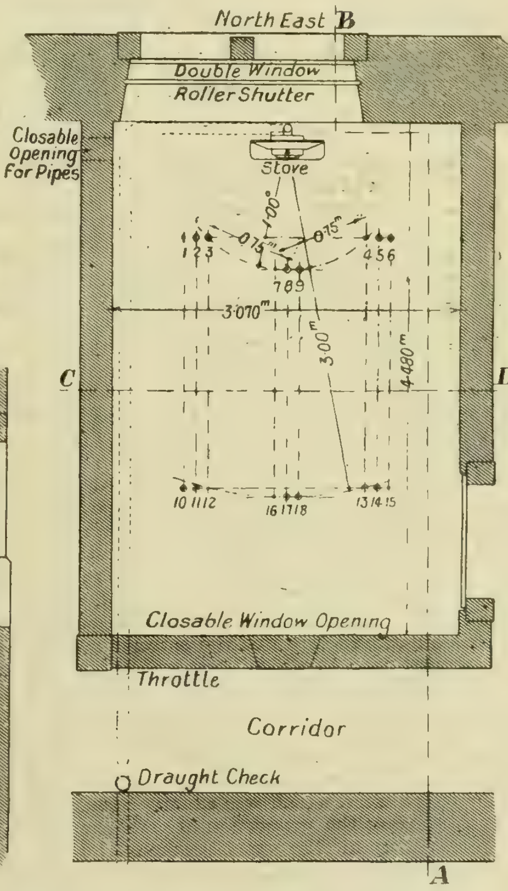
The Experimental Room.

The room used for the investigations was in the basement of the laboratory. On three sides, it had adjacent rooms; on the fourth, or northern, side only the upper half of the wall was exposed. On this side external influences were excluded by means of puttied-in double windows and an iron roller shutter. Openings in the wall for the door, and for admitting pipes, and the small window, were closed as carefully as possible, so as to render the room reasonably independent of the influences of the weather. Moreover, the investigations of distribution of temperature and of vitiation of the air were made on days when there was little wind. The position and the shape of the room, which was of about 1765 cubic feet capacity, are shown in fig. 1.

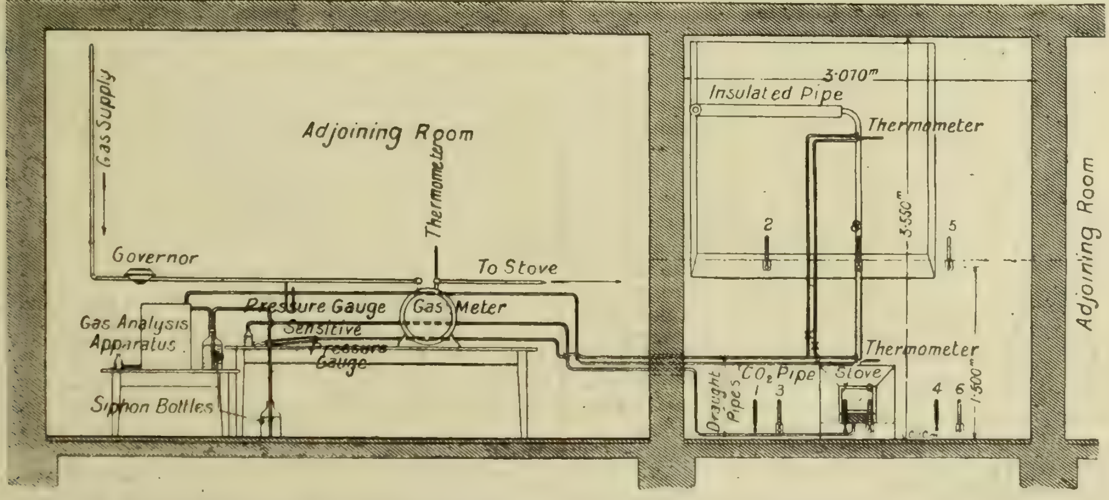
It was at first intended to make the temperature readings from outside; but it was found more convenient, in view of the distribution of the thermometers, to read them in the room itself. An observer, therefore, remained in the room while it was warmed up by the fire at full consumption, moving about as little as possible. He made the first set of temperature readings and, in addition, attended to the reduction of the rate of consumption when the desired room temperature had been attained. He also took samples of the air. While this method of taking the temperatures possibly did not give absolutely accurate results, it was permissible for comparative purposes, as the same method of working was followed in all cases. Practically the same readings were



Section on the Line A.B.



Plan.



Showing the Position of the Thermometers.

Section on the Line C.D.

[All dimensions in metres—1 metre = 39·37 inches.

Fig. 1.—EXPERIMENTAL ROOM.

obtained on repetition. When efficiency and radiation measurements only were being made, the door and shutter were opened.

Efficiency Testing.

The efficiency is well known to be greatly affected by the chimney draught; and in order to test the fires thoroughly for escape of products of combustion, a draught of only 0·04 tenth of an inch of water was chosen for the particular tests. With proper construction of the fire this draught should suffice to remove the whole of the products of combustion. In order to maintain the draught at this same figure for comparative purposes, the connection of the fire to the chimney became of importance, as many fires otherwise would not have obtained the desired draught. The immediate removal of the principal current of flue gases was necessary in order that escape of products of combustion might be traced through the detection of carbonic acid. Though the use of the flue-pipe gave somewhat more unfavourable results, they corresponded more nearly with those obtained in practice than if the pipe had been dispensed with. In order to ascertain the effect of flue draught on the efficiency, other tests were made with a draught of 0·12 tenth of an inch. The draught was controlled by means of a throttling flap and a draught check situated outside the experimental room. In an adjacent room readings of the draught were made on a micro-pressure-gauge filled with ethyl alcohol. It admitted of readings being made with precision to 0·004 inch of water. The pressure-gauge was of a differential type—both limbs being connected by glass tubes (one to the flue-vent and the other to the front of the stove) with the experimental room, but having in the connections three-way taps, by means of which the pressure in either limb could be brought to the prevailing atmospheric pressure.

The efficiency was calculated by the following simple and sufficiently precise formula drawn up by Dr. K. Bunte:

Efficiency percentage $= 100 - 100 \times \frac{a}{b} \times \frac{c\,(t \quad - t\ )}{H_n}$, in which

a = the volume of carbonic acid produced by the combustion of one volume of gas;
b = the percentage of carbonic acid in the hot humid flue gases;
c = the specific heat of the hot humid flue gases;
t_a = the temperature of the escaping flue gases;
t_z = the temperature in the middle of the experimental room;
H_n = the net calorific power of the gas in calories per cubic metre at 0° C. and 760 mm.

The percentage of carbonic acid in the flue gases was generally only determined directly—viz., about 12 inches from the gas-fire—as a number of samples taken at the exit from the room gave practically the same results. The flue gases for testing were sucked into an adjoining room and analyzed with an Orsat apparatus. On the other hand, the temperature of the flue gases decreases very rapidly as the distance from the fire increases. Therefore it was observed both at the flue vent from the fire and at the flue exit from the room—viz., about 10 feet from the floor. Ordinary chemical thermometers were used. For ordinary calculations it is sufficient to use a mean value for the carbonic acid produced on combustion and the calorific power of the gas; but in the present case, in which these values changed considerably, account was taken of the changes in order to increase the degree of exactness of the investigations. The carbonic acid produced on combustion was determined for the extreme calorific values by the combustion of 100 c.c. of the gas over copper oxide; and the calorific power was ascertained by means of an automatic Junkers calorimeter, which was exactly standardized.

For calculating the proportion of carbonic acid in the hot flue gases containing all the water produced by combustion in the form of vapour, it was assumed that about two volumes of aqueous vapour are formed with one volume of carbonic acid. The proportions of carbonic acid stated in the sequel are not the direct readings of the Orsat apparatus, but refer to the hot humid flue gases. The mean specific heat of the latter was assumed to be 0·32. Fires provided with an anti-back-draught device were tested both with and without it, in order to ascertain its effect on their efficiency. The efficiency of all the fires was ascertained both when burning at the maximum normal rate of consumption and at about half the rate.

Radiation.

The radiation was measured by means of a water calorimeter on the principle of that described by J. C. Clark in the "Journal of Gas Lighting" in 1910 [Vol. CXX.; p. 239], as subsequently adapted and used in the Laboratory of the United Gas Improvement Company at Philadelphia [*vide* "Progressive Age" of Dec. 16, 1912]. Some modification of it was done. The measuring instrument consists of a casing made of copper plate 0·03 to 0·035 inch in thickness, having the shape of an arch 2 metres (79·7 inches) in span, bounded by two meridians at a distance of 20°. The inner surface of this arch is exactly one-eighteenth of the upper surface of a sphere 2 metres in diameter. The greatest width of the apparatus, which takes the curve of a sphere, is 349 mm. (13·8 inches). The two surfaces of the case are 3 mm. (0·12 inch) apart. The narrow space thus provided holds only a little water, and hence a condition of equilibrium is attained after a few minutes. In order to ensure thorough mixing of the water, the space is provided with baffles, which are only lightly attached to the copper plates, and hence allow some water to take the shortest passage, and thus any dead angle spaces are avoided. The inner surface of the vessel, which faces the stove, is blackened. The back of the vessel is polished, and enveloped by another polished copper plate, 0·024 inch thick, which forms an air jacket. This third plate is not attached to the others by conducting material, and hence does not take up heat from them.

The whole vessel can be brought to any desired position by means of an arc lamp suspending cord and pulley. The water enters at both ends, and flows out in the middle at the top. Its increase of temperature is measured by thermometers graduated to 1-10th of a degree Centigrade. A constant head overflow ensures a uniform inflow of water, so that practically the same quantities of water were used for all the tests. The temperature of the air was determined by three thermometers attached to the back of the apparatus, and the temperature of the inflowing water was regulated so that the mean of the three thermometer readings agreed approximately with the mean of the inlet and outlet water temperatures. This was easily effected by regulating the air temperature by opening the door and window ventilators. Care was taken, however, to avoid draught; the smoke of fumigating pastilles rose vertically and not towards the calorimeter. The effect of convection on the measurements was excluded as far as possible, and the calorimeter gives records substantially only of the radiation of the fire. The apparatus is shown in fig. 2.

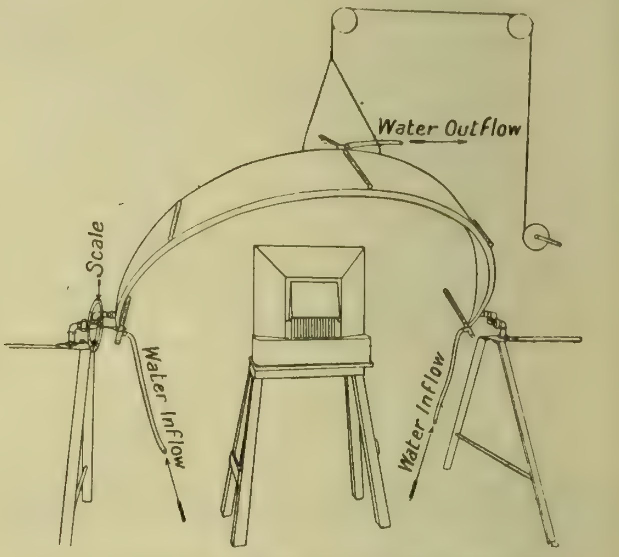


Fig. 2.—Radiation Calorimeter for Domestic Gas-Stoves.

This method occupies only half the time of that adopted by the [? Carlsruhe] Institute, by which radiation and convection are determined together, and then the effect of convection alone by cutting off the radiation by means of a copper screen. The method adopted at Zürich also appears to be more exact, as it is extremely probable that the screen cuts off more or less of the convection as well as the radiation. The radiation at the upper 30° cannot be measured by the new method, owing to the upward convection currents, which is a disadvantage of it in comparison with the bolometric method. But on the other hand, the latter method is more complicated, and is probably inexact for other angles. Moreover, this upward radiation is of comparatively little importance, both on account of its amount and direction. With many fires it would probably be less than the radiation from the back of the fire, which is reflected from the wall, and which hitherto has never been properly determined. The radiation for the bottom 30° was also excluded, as it was really very small, and, owing to the interference of the base of the fire, it could only have been determined with difficulty. The radiation was therefore determined at angles of 20° in the six directions shown by shaded lines in fig. 3. At the angle marked 6, the hot air currents rising from the fire were not interfered with; for it was shown that smoke rose up vertically.

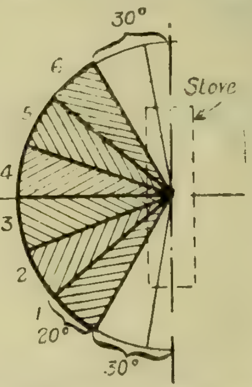


Fig. 3.—Angles at which Radiation was Measured.

In order to obtain rises of temperature sufficient to avoid errors, the fires were tested at full consumption. When the consumption was reduced to half, supplementary tests showed that the radiation was about in the same ratio. After conditions of equilibrium had been attained the measurement was made, extending over five minutes. It consisted of collecting the warm water flowing from the calorimeter and taking readings at intervals of a minute of all the thermometers. The rise of the temperature of the water when about 3 litres were passing in five minutes—the calorimeter holding about 2 litres—was never less than 0·2° C., and never more than 6·5°.

The heat radiated was calculated from these data in the usual way, and expressed as a percentage of the heat of the gas consumed in the same time. In order to get rid of air bubbles, it was necessary at the beginning of each test to move the calorimeter to and fro a few times. It then worked quite well, and can be recommended for comparative testings. The angles named can be all tested with it within half-a-day. The apparatus was made by a *Zürich* coppersmith, according to instructions. Scarcely any noticeable effect on radiation was caused by the use of the anti-down-draught devices.

Distribution of Temperature.

The distribution of temperature was ascertained by means of thermometers graduated in tenths of a degree Centigrade hung at different heights and at different distances from the fire. In order to ascertain the temperature of the air, as well as the effect of radiation on the room, some of the thermometer bulbs were protected with rolls of silver foil and others were blackened. Twelve thermometers were distributed in two circles with radii of 1 and 3 metres (39·3 and 117·9 inches), with the bulbs one-fifth of an inch from the floor. They were arranged in six pairs—one with the polished screen and one with the blackened bulb in each pair. There were also six thermometers with polished screens suspended with the bulbs, 1·5 metres (59 inches) from the floor, exactly over the middle line between each pair at the floor level. The mode of distribution is shown in fig. 1. Another unblackened thermometer was suspended in the middle of the room to ascertain the average temperature of the room.

The thermometers were read twice or thrice an hour in the closed room before each test, in order to ascertain that there was equilibrium of the temperature conditions. The fire was then lighted and kept burning at full consumption for 55 minutes, when the observer in the room quickly made temperature readings. The fire was checked to half consumption five minutes later, and a sample of air was taken from the middle of the room. The observer then left the room; and the continuous heating test, extending over three hours, started from this point. Two hours and 2 hours 55 minutes later all the temperatures were again rapidly observed, and a sample of air taken. Five minutes after the last set of observations, the fire was turned out. Temperature readings were made during the next three hours in order to ascertain the course of cooling. Air samples were also taken in order to get data on the renewal of the air. The door was left open slightly during the night, so as to bring about the state of equilibrium necessary for another test on the following day. The temperature of the outer air was observed throughout, and the weather conditions were noted. All tests were repeated twice or thrice; and the mean of concordant results has been given in the report.

The temperature distribution tests involve much more detail than the radiation measurements, and require suitable environment and quiet weather. The work done, however, shows that in future the distribution of temperature which a fire may be expected to give can be deduced with sufficient accuracy from its radiation results. With the exception of Type V. of the stoves tested, the temperature distribution tests were made without the stove being connected to the chimney, and with the throttle-valve fitted in the passage closed. The efficiency of 100 per cent. thus attained was adopted in order to exclude differences in the heat efficiencies of the fires, and thus to make the results solely dependent on the heat distributing qualities of the fire under test. Comparative experiments with chimney draught have not shown any appreciable differences. On the other hand, the radiation tests were carried out with chimney draught in order to avoid the effect of hot currents of effluent gas. But in this case also the results were stated as a percentage of the total energy applied, and not merely of energy utilized by the fire. The results were therefore brought on to the same basis. This procedure was permissible, because radiation is much less affected than room temperature by the method of removal of the flue gases. It depends to a much larger extent on the concentration of heat and the temperature thus produced of certain parts of the fire.

Hygienic Conditions.

The air from the vicinity of the fires provided with flue exits and from the middle of the room was tested for carbonic acid with a Haldane apparatus, which admits of smaller proportions of carbonic acid than 0·01 per cent. being read. It may be mentioned that the dew-plate ["Shadowgraph"] method was found insufficient, particularly for fires with burners not placed right in front. On the other hand, fumigating pastilles serve to detect any escape of flue gases. With fires in which individual heating flames are comparatively wide apart—which are objectionable on account of the uncertainty in lighting—faulty removal of the products of combustion may be detected from the smell of escaping gas when one burner is extinguished. The determination of carbonic acid, however, is the only trustworthy basis for determining the escape of flue gas.

The completeness or otherwise of combustion was checked by means of palladium chloride. In order to obtain results giving some quantitative indication of the proportion of carbonic oxide in the flue gases, the very sensitive palladium paper was not used for the purpose, because it indicates traces of carbonic oxide which are quite harmless. A dilute bright yellow solution of palladium chloride was used instead. It has been found that if about 5 litres of flue gas are passed through about 70 cc. of this solution, with frequent vigorous agitation, in the course of four hours, obvious discoloration ensues if the flue gases contain about 0·1 per cent, of carbonic oxide. Such a proportion of carbonic oxide is injurious to health, though it should be pointed out that with this proportion of carbonic oxide in the flue gases even considerable escape of them will not raise the proportion in the air of the room to 0·05 per cent., which is harmless. The heavy hydrocarbons which affect the reaction were retained by fuming sulphuric acid followed by a solution of caustic alkali to absorb any acid sprayed over.

Special importance was attached to observing whether gusts of wind interfered with the combustion, or caused the products of combustion to be expelled into the room. In making these tests, the throttle flap was quite closed and the flue gas was tested with palladium chloride for carbonic oxide. Measurements were also made of the temperature of the heated surfaces and of the air passing over them. Importance was also attached to the efforts of the makers to make the heating surfaces vertical and as readily accessible as possible, in order to prevent deposition of dust or to facilitate its removal. Finally the burner orifices should be so near one another that flame spreads over the whole when one burner is lighted. This prevents the dangerous extinction of a single flame due to initial condensation of water, which has the result that unburnt gas passes into the chimney or into the room.

(*To be continued.*)

SOCIETY OF CHEMICAL INDUSTRY.

Meeting of the London Section.

At a Meeting of the London Section of the Society of Chemical Industry, held at the Chemical Society's rooms, Burlington House, on the 3rd inst., under the chairmanship of Mr. A. R. Ling, F.I.C., there were five papers down for reading and discussion, as well as some exhibits of chemicals and apparatus the manufacture of which in Great Britain had only recently been undertaken. These exhibits included laboratory glassware by Messrs. Baird and Tatlock and Messrs. John Moncrieff, Limited, laboratory porcelain ware by Messrs. Doulton and Co., and some chemicals of the degree of purity required for use as analytical reagents by the British Drug Houses, Limited.

Owing to the full programme, only brief abstracts of most of the papers were read. One of the communications was on "The Viscosity of Oils in the Redwood and Ostwald Viscometers," by Messrs. C. Savill and A. W. Cox. The authors stated that the paper gave tables and graphs showing comparative results obtained for eleven different oils with the Redwood viscometer (which is the instrument in general use in this country) and the Ostwald apparatus, which gives absolute viscosities expressed in dynes per square centimetre. The graphs showed that the curves obtained for the same oil by the two methods were regular and parallel in all cases. It would therefore be possible, by plotting on a graph the results found by one of the methods for any oil, to deduce the corresponding readings by the other method.

Another paper, of which only a very brief *résumé* was given, was by Mr. R. C. Frederick, on "The Estimation of Carbon Dioxide in Air by Haldane's Apparatus." The author showed how the ordinary apparatus, the range of which is usually restricted to air containing less than 100 volumes of carbon dioxide per 10,000, could be adapted for use on samples of air containing two or three times this volume, by calibrating the capillary tube which extends upwards from the absorption pipette in such a manner that the volume between two marks on this tube corresponded exactly to 100 volumes per 10,000. By making the initial reading at the lower mark and the final reading—after absorption of the carbon dioxide—at a higher mark, it was easy to analyze with the apparatus samples of air containing more than 100 volumes of carbon dioxide per 10,000. The author also showed an arrangement for raising and lowering the mercury reservoir of the Haldane apparatus, consisting of a carrier for the reservoir connected by a cord passing over a pulley to a counterpoise, the travel of which was limited at each end by stops. This arrangement saved the labour of raising and lowering the mercury reservoir by hand, and also avoided the risk of mercury being driven over into the absorption pipette through the reservoir being raised too high, or of potash solution being drawn over into the burette through the reservoir being lowered too far. It thus made the apparatus as far as possible fool-proof. The author also mentioned that he had tried various means of stirring the water in the water-jacket, instead of blowing air warmed by passage through the lungs directly into it. He recommended the blowing of air at the temperature of the room through a vessel containing water, in order to saturate it with moisture, before passing it into the water-jacket.

Brief comments on the author's modifications were made by Dr. S. Rideal, Mr. W. J. A. Butterfield, and Mr. Jacques Abady.

HIGH-PRESSURE DISTRIBUTION.

By T. F. Waugh.

[Extracts from a Paper read before the New South Wales and Queensland Gas Institute, Oct. 26, 1915.]

Before dealing with the main subject of his paper, the author gave an outline of the growth of the Australian Gaslight Company's area, which eventually led to the general adoption of the high-pressure system as it exists to-day. He showed that gradually, owing to the rapid growth of the outlying districts, the pressure had fallen below that which was considered sufficient to give a good supply. To have remedied the trouble by means of further low-pressure mains would have meant an enormous capital expenditure, as nothing less than 18-inch mains would have carried the amount of gas required; and in many cases 24 and 30 inch mains would have had to be laid. It was therefore decided to lay comparatively small mains, carrying gas under high pressure, into these districts, and so reinforce the low-pressure system at points approaching the extremities of the affected areas. High-pressure distribution may be divided into three distinct classes: (1) Reinforcement of low-pressure supply by means of comparatively small high-pressure mains and district governors; (2) transmission to outlying gasholders; (3) direct supply to consumers by means of service-governors. Taking them in order, the following is a description of the work carried out by the Australian Gaslight Company.

Reinforcement by High-Pressure Mains and Governors.

A map of the whole area under supply was prepared, and the districts with poor pressures were marked. The mains maps were then consulted for each district in question; and the points where governors were necessary were all settled. The required high-pressure mains were then plotted, each route being gone over individually, so as to ascertain its feasibility. After this, the work of laying the mains and fixing the governors was put in hand. Generally 12-inch mains were laid. The governors were placed in brick pits in the footpath, with a manhole for access. These governors were of varying sizes, from 12 inches down to 3 inches, according to the size of the low-pressure main they were delivering gas into. We then had our supply reinforced at the points where it was required, and had also retained the original low-pressure supply. The result was that, instead of the pressure gradually dropping from a station-governor to the end of the district, we obtained pressure equal to that given by the station-governor at the extreme end of the district, and so brought our lowest pressure to a point somewhere midway between the two sources of supply. Providing this minimum pressure was not less than 20-10ths, there was no need to do anything further. If below this, all we had to do was to put in another governor at this point, and so bring the pressure up to the required amount.

A very good example of this method is the work we carried out between Gordon and Roseville. We had two 12-inch low-pressure mains supplied by the Roseville governor at Gordon running parallel for some distance. At a point some 3000 yards from the governor, they were connected together, and a 9-inch and finally a 6-inch main completed the distance to Roseville. The gas supplied by the governor was exhausted by the time it had reached the end of the 12-inch main, and so from there on to Roseville we had a poor supply. One of the 12-inch mains we decided to convert to high pressure, and continue through to Roseville. All connections off this original 12-inch main were cut off and transferred to the other 12-inch main. Reynolds governors were placed in pits at intervals along the road; the inlets being connected to the high-pressure main, and the outlets to the low-pressure 12-inch, 9-inch, and 6-inch mains. A connection was made from the 15-inch high-pressure main at Gordon to the converted 12-inch main. The governors were then set so as to give an outlet pressure of 35-10ths; and thus the pressure was equalized over the whole of the area. Another point worth noticing is that, whereas the station-governor supplying Roseville had previously been working at 50-10ths, it was now reduced to 35-10ths, so that the quantity of gas going out of the governor was considerably reduced.

This method was found so satisfactory that we have extended the system until, at the present time, we have something like 160 miles of high-pressure mains, with about 90 district governors working off them. These district governors are capable of sending gas out at any pressure between 10-10ths and 60-10ths; so that with a governor working at 30-10ths there is a considerable margin in the supply to cope with any increase in consumers and extensions before another district governor need be put in, or the high-pressure main further extended. The capacity of this system is apparent, compared with a low-pressure system. In the high-pressure system, the drop may be from the maximum inlet pressure at the boosters to the minimum pressure at the end of the district, which latter we fixed at 8 inches, so that we have at present a permissible drop of 62 inches. Under the low-pressure system, our maximum outlet pressure is fixed at 50-10ths; and to give a reasonable supply to consumers, our minimum pressure should not be less than 20-10ths, so that we only have a permissible drop of 30-10ths.

The flow of gas in a main under low pressure increases as the square root of the pressure; so that to obtain twice the quantity of gas would require four times the pressure, and so on. For high pressures, this is not correct, as the flow is more nearly in direct proportion to the increase in pressure. Hence, we not only have the addition of a much bigger available drop in pressure, but also our delivery increases almost in proportion with the pressure. Take an instance of a 12-inch main 2000 yards long, with an initial pressure of 50-10ths and a final pressure of 20-10ths. This main would deliver 3360 cubic feet per hour. The same quantity of gas could be delivered by a 3-inch main under high pressure with an initial pressure of 70 inches, and a final pressure of 10 inches. This comparison shows that 3-inch and 4-inch mains under high pressure will have a very long life before they become over-taxed. Further, by using high pressure in preference to low pressure, considerably less capital expenditure is required to deliver the same quantity of gas. The only increase in cost is for the boosting; and this is so small that the advantages gained outweigh it. This cost will vary considerably, according to the size of the plant and the quantity of gas sent out every 24 hours. In our own case, the cost is approximately ⅕d. per 1000 cubic feet. This figure is derived from the total quantity delivered over the twelve months; and it may interest you to know that for the year to June last, the Company sent out 4,481,000,000 cubic feet.

The governors which we use are the Reynolds—an American patent made by the Bryan Donkin Company—which have proved quite satisfactory in use for a period of four years. They are of the leather diaphragm type, and have no mercury, oil, or water seals. They are positive in action; and if properly attended to, give no trouble. It is almost impossible for the governor to fail, and let the high pressure through into the low-pressure mains. We have only had two cases where a governor failed to operate, and in each case the pressure rose to 6 inches, which was by no means the pressure in the high-pressure main. This excess pressure was purely local, and was detected in a very short time, owing to complaints being received of poor supplies; the reason, of course, being that the float in the meter had practically shut the gas off owing to the difference of the water-level. Nearly all these governors are fixed in brick pits in the footpath. Each pit is about 5 feet wide by 6 feet long and 5 ft. 6 in. deep; so that there is plenty of room to get round the governor for cleaning purposes, &c. Wherever possible, the pits are drained. Eight-day "Bristol" recording gauges in water-tight cases are fixed on the inlet and outlet. The cards on these gauges are changed once a week, any irregularity on the records noted, and the governor in question at once examined for any defect. A note is made on the card as to the reason for any variation of pressure, and the card is filed for future reference.

The outlet pressure of the governor does not vary more than 1-10th or so over the 24 hours, except in cases where the station-governor supplying that part of the area is giving out a higher pressure than the local governor is set for. In such a case, the Reynolds governor remains closed until the demand reduces the pressure in the low-pressure mains to the same as the outlet pressure of the Reynolds governor, when the latter opens up and maintains the supply. In most districts these governors remain closed during the greater portion of the 24 hours—only opening in the early morning, mid-day, and evening. By this means, we are able to give an almost constant pressure over the whole of the 24 hours, which is what we are all aiming at, but which, with a low-pressure system of any size, is utterly impossible. This variation in pressure, which cannot be avoided with the generally accepted method of distribution by means of station-governors and comparatively large sized trunk mains, is the cause of the majority of complaints of poor supplies and also of poor gas, as no incandescent burner will stand much variation in pressure without being regulated to suit the alteration. Consequently, as soon as the pressure is reduced at night by reason of the increased consumption, the consumer immediately notices the light going down, with the result that a complaint is received in the morning of a poor supply.

Transmitting Gas to Outlying Holders.

We now come to the transmission of gas to outlying holders, which does not call for any special description, as it has been in use for many years. In this case the main supplying the holder, if large enough, or if the holder itself can be filled during the night, can be used for supplying districts *en route*, by means of governors, as in the previous system. If the main passes any isolated houses, they can be picked up by means of a direct high-pressure supply and a service-governor on the meter, which will reduce the pressure down to the required number of tenths. This method I consider the ideal system of supply; and this brings us to the third system—direct supply of consumers by means of service-governors on the meters.

Service Governors on Meters.

There may be some portion of the area supplied, to which the reinforcement of the low-pressure system cannot be applied; and here is an opportunity for supplying consumers direct from a high-pressure main. We had one instance of this. It was a very scattered area with comparatively few consumers, about 17 per mile, and 8½ miles of 4, 3, and 1½ inch mains supplying these consumers. This net-work of small mains was supplied from an 18-inch low-pressure main, which at that point had a maximum pressure of 35-10ths. I do not like to say what the pressure was at the end of the district. Running parallel with the 18-inch low-pressure main was a 9-inch high-pressure main with a pressure of somewhere about 50 inches at the point where the supply was taken off the 18-inch main to the district in question. To relay the ow-pressure mains with larger ones was out of the question, on ccount of the cost in relation to the revenue. The same thing pplied to laying a high-pressure main to the extremity of the disrict and reinforcing by means of a Reynolds governor. The olution appeared to be to convert the whole area into a high-ressure system, and supply the consumers through governors xed at the meters.

The first thing to be done was to fix a service-governor on every eter, and then make a connection from the 9 inch high-pressure ain to the 4-inch low-pressure main where it came off the 18-ch main. Two valves were put in, one on the low and one on he high pressure connection; the high-pressure valve being left hut. We were then ready to convert to high pressure as soon as he service-governors were set. On the day fixed for changing ver, a number of fitters each provided with a water-gauge started ut in the morning to set, approximately, 140 service-governors. hey finished at about 1 p.m., and reported all service-governors et to 30-10ths. These service-governors were weighted with the ame number of weights as we had found to give 30-10ths outlet ressure when the governors were tested at the works, before eing sent out. All that now remained to be done was to change ver the connection. A 12-inch water-gauge was fixed on the -inch low-pressure main close to the valves, and the valve on the igh-pressure connection was gradually opened until the pressure ose to 45-10ths, when the low-pressure valve was closed and the igh-pressure valve was opened further, until the gauge showed inches. The fitters were again sent round to all governors, to see f they had taken up the pressure correctly. On the fitters' reurn, and reporting all governors right, the high-pressure valve as opened up full. A gauge fixed at the extreme end of the istrict showed over 40 inches; so that we were satisfied that from hat date on everyone in the area would have sufficient gas for ome time to come.

This system has now been in operation a little over two years; nd has been an unqualified success. No single failure of a ervice-governor has occurred; and the complaints received from onsumers are 43 per cent. less than were received from the same umber of consumers supplied by low pressure in a similar area. o alterations were made to the mains or services, so that the xpense was simply the cost of the governors and fitting, *plus* the ost of the connection to the high-pressure main. The total cost orked out at £288, or a shade over £2 per consumer. All the onsumers have an absolutely even pressure of 30 10ths over the hole 24 hours. The pressure in the system varies from 7 inches uring the night to a maximum of 50 inches during the hours of aximum consumption. Since converting this district, we have dded another 60 consumers, none of whom could have been suplied on the then existing low-pressure system, as the mains could ot even supply the consumers already connected. Another area n which about 200 consumers had been applying for gas for the ast four years, but which we could not supply under low pressure n account of the expense, has since been laid with high-pressure ains, and consumers are supplied in the same manner as in the revious case. Here, again, complaints are less than with the rdinary low-pressure system.

The governors themselves need very little attention. One fitter xamines them every six months, taking about three weeks to go ver 200. The leather diaphragms have a life of about two years, ut are renewed, if required, at the bi-annual examination. Street-ights in these areas are treated in a similar manner. A half-inch ervice-governor is fitted just under the lantern, which reduces he pressure to 30-10ths; the burners themselves being adjusted o the required consumption, exactly in the same way as they are hen used on the low-pressure system.

Perhaps the most important point in this system of supply is hat the consumers have an unvarying pressure, irrespective of he demand; and so we get rid of a number of complaints of poor upply which exist on a low-pressure system, and which are caused y the pressure rising when the station-governors are opened, and hen gradually falling to the minimum point during the period of aximum consumption. This drop in pressure, which may be as uch as 25-10ths, is what the consumer notices, as no incandescent urner can be adjusted to cope with a drop such as this. The nly way to rectify this is to fit some form of low-pressure governor, and set it to within a few tenths of the minimum pressure; and if we are to use governors at all on a consumer's service, then why not supply the consumer direct from a high-pressure main, and give him an absolutely constant and efficient pressure.

TESTING HIGH-PRESSURE MAINS.

One point I will put stress on in laying high-pressure mains is that they should be tested to not less than 10 lbs. per square inch, or, preferably, before being used for gas, that they should, after being pumped-up, remain at this pressure without any appreciable loss for 24 hours. The test can be carried out from day to day as the main is being laid, and any leaky joints be immediately discovered and rectified before the ground is filled in. When we started this method of laying mains, we found that nearly every joint leaked; but very soon the men made joints which stood the test required. I even think it well to similarly test low-pressure mains in cases where they are laid dead, as this will preclude any chance of leakage either in the joints or fittings. Money spent on testing while the work is being done is saved in the long run, as it is much more costly to have to open-up and look for leaks at some later period. With gas at 3s. 10d. per 1000 cubic feet, every cubic foot per hour represents a sum of 30s. per annum, which, even in a small distribution system with (say) a leakage of 10 per cent. of the gas made, will amount to a considerable sum per annum.

Nearly all our high-pressure mains are laid with steel pipes in lengths of about 30 feet. This roughly reduced the number of joints per mile to one-third of the number which would be required with cast-iron pipes. This is, in itself, a considerable factor in the reduction of leakage, over and above the fact that cast iron is more or less porous compared with steel. Every high-pressure main should have sufficient valves along the route to control the pressure, if required, in order that any further extensions may be made without difficulty, as no bags or stops can be relied upon to hold against a pressure greater than 10 inches. In cases where the pressure cannot be reduced, resort will have to be made to some form of under-pressure drilling apparatus.

Generally speaking, far too little care is exercised in laying services. Pipes are half screwed home, and then a dab of red lead is given to the remainder of the thread, and the joint screwed up. This will not do for high-pressure work. The joints must be painted inside and out with a mixture of red and white lead (half-and-half) and boiled oil. This mixture does not set hard, and therefore, any movement of the pipes after laying does not break the joints and so cause leakage.

DISTILLATION OF PEAT.

In the "United States Commercial Reports"—No. 272, dated Nov. 19—Mr. C. A. Holder describes a new patented process for the distillation of peat, by which coke, fuel oil, toluol, ammonia, paraffin wax, and acetone are obtained "in sufficient quantities and of such high grade as to prove of great value."

Peat, as taken from the peat beds, the article continues, contains from 80 to 90 per cent. of water, and is of a fibrous cellular structure; so that by hydraulic pressure it is possible to lower the water content only slightly. An important part of the new process is a macerator, that breaks-up the fibrous cellular tissue, and thus allows a more complete separation of the water. After passing through the macerator, the broken peat is compressed into briquettes, which are dried until they contain not more than 25 per cent. of moisture; and they are then fed into a hopper, from which they pass into the retort.

The retort, though very simple, is the basis of the patent. It contains several chambers where different degrees of heat are applied. In the first a temperature of 300° C. (572° Fahr.) is used for driving out the moisture remaining in the peat. In the next chamber the temperature is about 450° C. (842° Fahr.); and here decomposition of the peat takes place. In the last chambers, the temperature runs up to 600° or 800° C. (1112° to 1472° Fahr.), and the oil and water are volatilized. By means of a worm screw, briquetted peat is passed in at one end of the retort, and peat charcoal is discharged continuously at the other end; while from the various chambers the oil, water, ammonia, &c., are drawn off as vapour, and removed from longer contact with the heat.

After leaving the chambers, the vapours pass through a condensing system so arranged that the heavy oil collects at one place, and the water and light oil in the form of vapour, together with some combustible gases, collect in another place. The combustible gases are separated from the water and oil, and are utilized in keeping-up the temperature of the retort, after it has obtained its initial heat from coal; and they are ordinarily sufficient to carry on the subsequent processes without the addition of any further coal.

The coke obtained by the process contains 92 per cent. of carbon, 1 per cent. of moisture, 1·3 per cent. of volatile matter, and 5·7 per cent. of ash It is very hard. It can be left with a larger percentage of moisture; and in this way, since it is softer, it can be used as fuel for domestic purposes. Its chief value, however, is in the manufacture of steel, owing to its wonderful hardness and the high percentage of carbon contained. Various steel makers have certified to its great value for this purpose. From a ton of peat nearly one-third of a ton of coke, valued at $6·08 to $7·30, is obtained.

The oil promises to be particularly useful as a fuel, because of its low sulphur content. An examination of the oil showed it to be a most satisfactory substitute for petroleum. The amount of ammonia obtained per ton of peat is estimated at 20 lbs., with a value of 2 c. or more per pound. Both the oil and the ammonia contain water; but this is readily removed by the application of heat. In addition to these products, about 20 lbs. of paraffin wax, valued at 6 c. to 8 c. per pound, is obtained, and toluol and acetone. The quantity and value of the latter have not yet been ascertained.

With peat costing about $1·95 per ton delivered in the hopper, dry, it is believed that by this process a profit of not less than $3·65 or $4·87 per ton will be obtained; and this does not include any allowance for the toluol and acetone, which may prove to be more valuable than all the other products together.

Peat from different localities gives different results—some peat containing larger amounts of volatile matter than others, and some having a low nitrogen content, while in others it is high. The yield of oil from Yorkshire peat was 26·5 gallons per ton. By varying the conditions of distillation, light or heavy oils may be produced as desired. The yield of oil, gas, and ammonium sulphate can be controlled by regulating the length of time or the degree of heat to which the peat is subjected in the retort.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Increased Toluene Production.

Sir,—Should Mr. Rollason care to read my article again, he will find a paragraph as follows: "The increased quantity of bye-products was negligible; and their value was counteracted by the increased ash and sulphur content of the coke." As "bye-products" referred to a coke-oven plant, and includes crude benzol and tar, it follows that the toluene was not appreciably increased.

I fail to understand how Mr. Rollason arrives at the conclusion that the coal used was high in sulphur, as no figures relating to the sulphur content were given. The temperature of maximum decomposition of limestone is about 812° C.—providing the dissociation pressure is higher than the containing pressure; and if this holds true, limestone can not be used with the "special object" of retarding the evolution of hydrocarbons which come off at an early period of distillation, as it is itself decomposed into CaO and CO_2 at a much lower temperature than 812° C., if under a vacuum, as in a coke-oven.

I note Mr. Rollason says: "Many gas-works are at the present time working to the full capacity of their carbonizing plant." This is quite true; and the fact that many are not, while most gas-works have a "slack" season during the summer months, must not be overlooked.

I cannot dispute Mr. Rollason's figures, which were obtained from experiments conducted at a gas-works; but his toluene yields are extraordinarily high, and give a total of 6 lbs. per ton of coal carbonized on an ash-free basis, against 4·5 lbs. per ton of coal carbonized on an ash-free basis, as quoted on the brochure of the Synthetic Gas Processes Company.

It must not be forgotten that the addition of limestone to coal means an increase in ash content; and this cannot be overlooked by coke-oven people.

Finally, let me quote some figures obtained at the Birmingham experimental plant, using the same quality of coal.

	1.	2.
Percentage of lime	*Nil.*	1·91
Charge of coal—cwt.	8·03	8·03
Make per ton—cubic feet	11,740	11,780
Illuminating power, No. 1 Argand	15·35	15·24
B.Th.U.—net	526	516
Tar—gallons per ton	13·6	13·1

The composition of the gas varied very slightly, with less sulphur from the limed charge. The ash in the coke increased by 4·3 per cent., and the sulphur by 0·17 per cent.

B. Dunglinson.

Jan. 6, 1916.

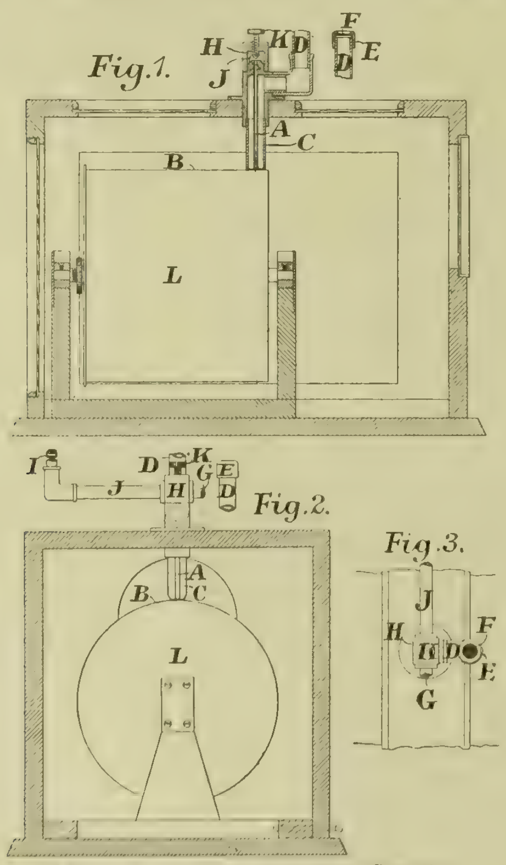
REGISTER OF PATENTS.

Sulphuretted Hydrogen Recorder.

Edwards, A., of Leeds.

No. 379; Jan. 9, 1915.

The gas to be tested is brought into contact with lead paper prepared in the usual way, and used either wet or dry; and the invention is characterized by "the intimate application of an adjustable jet of gas to a prepared moving surface without introducing friction or mechanically fouling the prepared surface, and without the use of liquid seals or sealed chambers, in such a manner that the action of the sulphuretted hydrogen impurity is localized, and that the gas used is automatically collected and disposed of by combustion without nuisance." To effect this end, "advantage is taken of the lesser specific gravity of gas and air mixtures as compared with that of air alone."



Edwards' Sulphuretted Hydrogen Recorder.

Fig. 1 is a sectional side elevation of the apparatus; fig. 2 a front elevation (partly in section); and fig. 3, a plan of part of fig. 1.

The jet of gas issuing from the lower end of an upright small-bore jet pipe A impinges directly and intimately upon the paper B (carried by a revolving drum), slightly below the jet orifice but not in actual contact with it. It ascends an outer glass tube C surrounding the lower portion of the jet pipe; and then passes automatically into an upright suction tube D, which is surmounted by a cap E carrying wire gauze F where the gas is burnt with a non-luminous flame. The length of the tube D is so adjusted that the ascending column of gas draws air through the space between the paper and the tube C, and so prevents any escape of gas at this point; while the end of the tube C is so shaped that the action of the gas is localized upon the paper.

A constant flow of the gas to be tested is maintained through the inlet pipe G; then through a jet pipe inlet chamber H; and the gas is finally led away to a pilot light I by way of an outlet pipe J. The volume of the gas impinging upon the paper is regulated by a needle screw adjuster K fitted in the chamber H to give the desired sensitiveness—say, 0·3 cubic foot per hour.

The prepared paper, bearing printed hour lines, can be applied in strip form and led past the jet pipe orifice, or it may be in disc form supported about a vertical revolving shaft, or (as illustrated) in ordinary sheet form disposed about the circumference of a revolving cylindrical drum L, arranged to take seven daily records by successive lateral displacements of the drum or drum support.

Five jets may, the patentee points out, be disposed side by side above a single cylindrical drum, and coupled to the main inlet and the four outlets of a set of four purifying boxes—"the records serving as a check upon the working, particularly where the backward rotation system is in use."

Instrument for Measuring Radiant Energy.

Richmond Gas Stove and Meter Company, Limited, and Hartley, H., of Warrington.

No. 1733; Feb. 3, 1915.

This invention has reference to "apparatus for measuring or ascertaining radiant energy, and more particularly heat energy; and it has for its object to provide an accurate, simple, and easily-used apparatus or instrument for this purpose."

Any details of construction of the radiometer referred to are not needful in this connection, as full particulars regarding it were published in an article that appeared in the "Journal" for March 30 last year, when an illustration was given [fig. 3, p. 794] similar to that which accompanies the present patent specification. It may, however, be interesting to state the claims made by the inventors. They are as follows:

1.—An apparatus for measuring or ascertaining radiant enegy, comprising a casing or container, a metallic heat absorbing body within it, and a separate means for indicating or determining temperature changes in the body.

2.—An apparatus for measuring or ascertaining radiant energy, a casing or container adapted to be maintained at a constant temperature, a metallic heat absorbing body within it having connected with it a thermometer, an opening in one side of the casing or container through which the radiant heat strikes the body, and a screen adapted to be moved in front of, and from in front of, the said opening.

3.—An apparatus for measuring or ascertaining radiant energy comprising a container or casing, and a heat-absorbing body within it, and adapted to be held in place in it by clamping means.

4.—Apparatus for measuring or ascertaining radiant energy, constructed and adapted to be used substantially as set forth and shown.

Igniting Apparatus for Gas-Burners.

South Metropolitan Gas Company and Buckett, W. J.

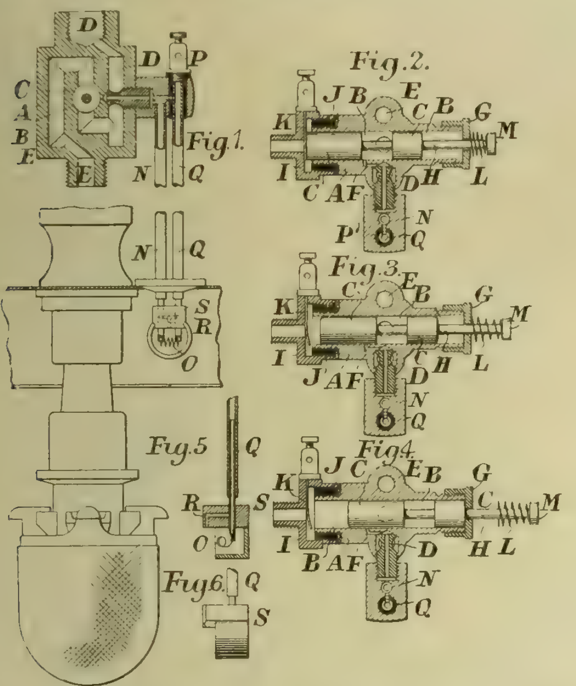
No. 3690; March 8, 1915.

This invention refers to electrically ignited gas-burners in which a bye-pass jet is first ignited by a filament brought to incandescence by an electric current; the burner proper being lighted from the bye-pass in the ordinary way.

Fig. 1 (p. 95) is an elevation of a gas-burner, partly in section, with the invention applied to it. Figs. 2, 3, and 4 show in horizontal sectional plan the valve for the supply of gas to the burner and to the bye-pass in three positions—viz., burner and bye-pass supplies both open; burner supply open, and bye-pass closed; burner and bye-pass supplies both closed. Figs. 5 and 6 are sectional and outside views of the bye-pass ignition device detached.

The pneumatically operated valve employed is of the horizontal piston type, and arranged to work differently from any previously used of this character, so as to supply both the burner and the bye-pass, to cut off the latter without cutting off the former, and to make and break the electric circuit as and when required. The valve comprises a metal casing A in which is a horizontal cylindrical chamber B for the piston C. The chamber has, however, besides the gas inlet D and the outlet E to the burner, an additional outlet F, which leads to the bye-pass; and the piston C is so formed that it is capable of covering both the main gas-passage and the outlet F simultaneously (as in fig. 4), uncovering both passages simultaneously (as in fig. 2), or covering the outlet while the main gas-passage remains open (as in fig. 3). The chamber B has at one end a cap G with a central hole, in which the rod H of the piston works; and at the opposite end there is the union

I, to which is connected the pipe of a pneumatic switch [not shown]. The union is insulated from the casing by the insulating bush J, but has a terminal for connecting to one lead of the battery. Inside the union is a contact-blade K adapted to meet the piston when it is moved to that end of the chamber B. On the rod of the piston is a spring L arranged between the cap G and the head M.



Buckett's (South Metropolitan Gas Company) Gas-Burner Igniter.

The valve shown is arranged to act by suction; and when suction is applied by the pneumatic switch, the piston is drawn into the position shown in fig. 2 and the spring L is compressed. In this position, as stated, the gas-passages to the burner and to the bye-pass are both open, and the electric circuit is complete through the blade K, the piston, the casing, the metal pipe N, the filament O, the metal pipe Q, and the terminal P, which is connected to the battery. The gas for the bye-pass flows by both pipes N and Q to passages R in the fire-clay block S, whence issues an igniting jet. The opposite ends of the filament are held in the ends of the pipes N Q, which are made telescopic so as to be detachable and adjustable longitudinally. The fire-clay block, the ends of the pipes N Q, and the filament O form together an igniting head, which is movable with regard to the burner without disturbing the distance between the gas outlet and the filament as previously set or adjusted.

When the piston is in the position of fig. 2 the ignition takes place; but as it is undesirable to maintain the filament in a state of incandescence and keep the bye-pass open after the ignition has taken place, the strength of the spring L is so adjusted that, as soon as the suction weakens (which will be the case in a short time owing to the fact that the joints are not absolutely air tight), the spring will move the piston so as to clear the contact-blade K and cover the outlet F which leads to the bye-pass, thereby cutting off the electric current and the igniting gas-flame. The spring pressure is not sufficient to do more than this, and therefore the burner remains alight until the pneumatic switch is operated in the opposite direction to move the piston C to the position shown in fig. 4.

Charging Gas-Retorts, and Withdrawing Coke therefrom.

Bancroft, F. J., and Hansford, J. B., of Barnet.

No. 4602; March 24, 1915.

This invention relates to apparatus whereby stop-end retorts can be charged substantially in one, two, or more operations, in a manner similar to that described in patent No. 13.218, of 1914; while the coke can be withdrawn through the charging door after distillation. For the latter purpose a withdrawal or drag device, longitudinally movable within the retort, is, according to the present invention, operatively associated with the charging apparatus indicated.

The charging portion of the apparatus (except for some modifications) is similar to that described in the earlier patent. The central portion of the charging bed, however, according to the present invention, has to be curved or arched to enable it to ride over the drag bar or bars.

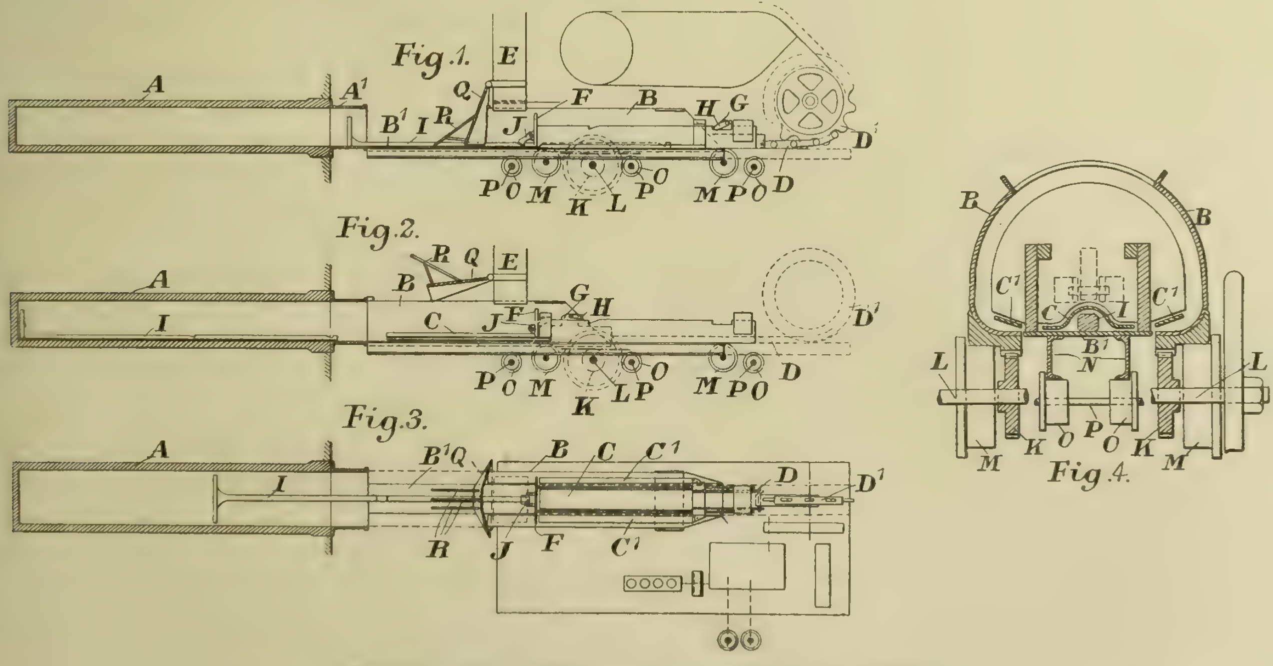
Fig. 1 is a part longitudinal section and elevation of the charging and discharging apparatus; the bottom of the charging trough being in the charging position in front of a retort with the discharging drag bar withdrawn. Fig. 2 is a similar view, showing the positions the parts assume during the charging of the trough with coal. Fig. 3 is a sectional plan; the drag bar being only partly withdrawn from within the retort. Fig. 4 is a cross section (to enlarged scale) showing the charging bed or tray, the trough, and the means for shifting the sides of the latter. The apparatus shown is designed to be mounted on a trolley or carriage in which it is adjustable, both vertically and horizontally, to enable it to be brought opposite the mouth of any retort to be operated on.

A is a retort, B and B^1 are the sides and bottom of the charging trough over which the charging bed or tray, consisting of plates C C^1, is adapted to travel forwards and backwards when pushed or drawn in customary manner by the chain D driven by the sprocket wheel D^1. E is a shoot by which coal is fed on to the tray—being connected with a hopper carried by the trolly. The charging-head F has rearwardly extending rails of comparatively heavy section and connected together by a bridge plate. The central plate of the charging bed is arched to allow of it riding over the drag-bar I. The central and side plates C C^1 are connected at their rear ends by a double bridge arrangement as described in the 1914 patent. To the bridge are attached side plates carrying brackets G, with pivoted catches or dogs H that can be turned into positions in which they engage with notches on a rail F when the charging head is to be moved simultaneously with the charging bed.

The drag-bar I has a turned-up head, and is provided with notches at suitable distances apart along its length. It can be pushed forward along the retort by hand, or by the charging apparatus, into the position shown in fig. 2, and be withdrawn through the charging door of the retort by engaging a claw clutch or equivalent member J, pivotally mounted on the charging head F, with one or other of the notches on the drag-bar, and then retracting the head, and with it the drag-bar. By means of the series of notches the drag-bar can be withdrawn by stages; and as it is withdrawn it slides along the bottom of the charging trough—being provided with an aperture for the passage of the bar.

Besides the notches formed at the rear ends of the rails of the charging head and employed in co-operation with the pivoted catches or dogs H for reciprocating the charging head simultaneously with the charging tray, as described in 1914 specification, additional or auxiliary notches are provided along the length of the rails; so that if the charging tray be pushed into the retort and subsequently withdrawn to a small extent, then, by engaging the pivoted dogs H with a pair of the auxiliary notches, the charging head can be advanced within the retort to a further extent than before. Thus any cavity existing in the charge deposited in the retort will be obliterated by reason of the additional push imparted by the head to the deposited charge. This "push-up" shot may be repeated as often as necessary.

The charging trough, according to this invention, is formed with its bottom plate or portion B^1 separate from the sides B. The bottom



Bancroft and Hansford's Retort, Charging-Discharging Machine.

plate, owing to the pressure of the movable parts of the charging structure upon it, is moved together with them, when the apparatus is to be adjusted so as to register with the retort mouthpiece. The sides B of the trough are adapted to be moved independently of the bottom plate in longitudinal directions relatively to the plate by means of suitble mechanism. In the drawing, the sides of the trough are fitted with sets of dependent parts having rack teeth adapted to mesh with toothed pinions K keyed to rotatable shafts L, on which are also loosely-mounted flanged rollers M, on which the dependent parts are arranged to bear. By turning one or other of the shafts L the sides B will be racked or traversed along; being guided by rollers M.

The bottom plate of the trough may be arranged to rest on longitudinal girders N that bear on flanged rollers O loosely mounted on spindles P.

When coke is to be withdrawn from a retort, the bottom plate of the charging trough is advanced to the retort mouth and locked in position —the sides of the trough remaining in the retracted position, as shown in fig. 3. The drag-bar I, with the turned-up head, is then drawn out through the charging door by hooking the claw clutch J into a notch of the bar and retracting the charging head. As the bar is retracted it slides on to, and along, the bottom plate B¹ of the trough; but its withdrawal can be effected in one or more stages as explained, by making use of the series of notches.

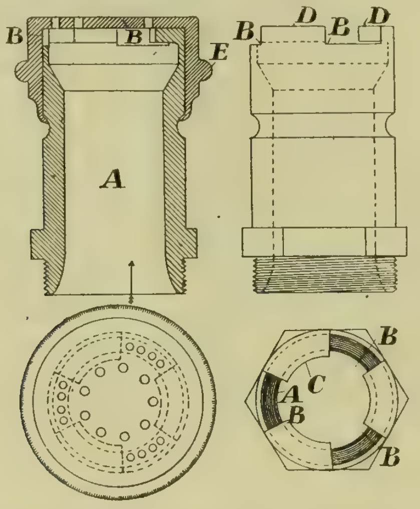
With a view to clearing the bottom plate of the trough of the coke as it is withdrawn and causing it to fall in a desired direction, guide-plates or distributors are provided. These consist of plates Q suitably shaped and pivotally supported from the sides of the charging shoot E leading from a storage hopper arranged above the trough; and they can be turned into, and out of, the operative position as desired. The guide-plates may be fitted with one or more forwardly projecting bars R for the purpose of breaking up the withdrawn coke or residues before reaching the guide-plates.

Regulating the Gas Supply to Atmospheric Burners.

Yates, H. James, of Essex Works, Aston, Rose, A., and Bellamy, W., of Hockley Hill, and Dolphin, J., of Harborne, Birmingham.

No. 3868; March 11, 1915.

This invention has reference to that type of regulating means in which a perforated cap is adapted to rotate upon the top of a nipple in which holes are so arranged that, by rotating the cap so as to increase or decrease the number of perforations in the cap registering with the perforations in the nipple, the supply of gas can be increased or diminished. The opening in the top of the nipple is so arranged that the gas constantly passes through the perforations in the central area of the cap which are not affected by the turning of the cap.



Yates, Rose, Bellamy, and Dolphin's Atmospheric Gas-Burner.

A sectional elevation is given of a gas supply nipple and cap in accordance with the invention; also a plan of same, a side elevation of the nipple separately, and a plan of the top of the nipple with the cap removed.

The internal diameter of the top of the nipple is preferably made larger than the internal diameter of the base or main portion of the nipple at A; and this top part is made with a partial internal flange divided into (preferably) three equal parts by substantially radial slots B, which extend from the central opening C of the flange to the periphery and are cut through the flange into the enlarged top portion of the nipple. Fitting on the flat top D of the nipple is a perforated cap the central area of which, corresponding with the central aperture in the flange of the nipple, is perforated with holes for the constant passage of the gas through the cap, and outside this area the cap has (say) three groups of perforations; preferably arranged in one and the same circle concentric with the cap—the groups of holes corresponding in number with the alternate gaps B and solid portions of the flange on the top of the nipple. The cap fits closely against the uncut away portions of the flange by the rim of it being closed into an annular groove so arranged as to permit of the cap being turned when its milled edge E is gripped.

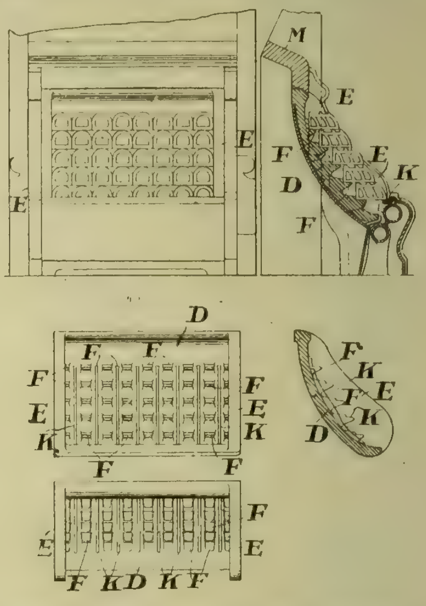
The gas, rising through the body of the nipple, expands as it passes into the upper part of larger diameter, and a portion of the expanded gas passes through the constantly open holes in the central area of the cap; and when the cap is turned to such a position that the three groups of perforations in the outer ring coincide with the three gaps B in the top of the nipple, the gas passes through all the perforations. But by turning the cap through a small angle, one, two, or more of the perforations in each group in the outer ring of perforations will be closed by riding over the solid portions of the end of the nipple, until, when the cap is turned through a sufficient angle, all the outer perforations will be closed. Owing to the fact that the gas, after passing through A, has expanded in the enlarged upper part of the nipple before passing through the perforations, "the roaring or hissing noise of the burner is prevented or minimized."

Gas-Fires.

Fletcher, Russell, and Co., Limited, and Banks, W., of Warrington.

No. 12,068; Aug. 21, 1915.

In a gas-fire according to this invention, the front of the fire-brick or backing is dished or concaved between the sides, so that it curves upwardly and rearwardly from about the horizontal to about the vertical, and is provided with projections for supporting the radiants, which are arranged in rows disposed one above the other.



Banks' (Fletcher, Russell, and Co.) Gas-Fire.

A front elevation and a transverse section of one form of the fire (fitted in an ordinary coal fireplace) are given; also a front elevation, transverse section, and plan of the fire-brick or backing.

The front surface D of the fire-brick is dished or concaved between the sides E so that it curves upwardly and rearwards from about the horizontal to the vertical. The front surface has formed on it rows of projections F for supporting the rear ends of the radiants, the front ends of the first row of which rest on a lip H, and each of the other rows on the row immediately below it. The radiants thus also curve or slope upwardly and rearwardly, similar to the front of the fire-brick.

The nozzles of the burners are inclined so that they direct the gas-flames between the columns of projections more or less in the direction of the initial part of the curve of the front of the fire-brick. Ribs K are provided on the curved surface of the fire-brick between the projections, and the space between the top of the fire and the back of the fireplace is closed by a tile M of refractory material.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

London Street-Lamps.

Mr. George Terrell asked the President of the Local Government Board whether his attention had been called to the waste of electric energy which was taking place in the London district by the blacking over of the powerful street-lamps as a protection against hostile aircraft raids; and whether he would take steps, in the interest of public economy, to require that, instead of blacking powerful lamps, these lamps should be replaced by lamps of lower candle power?

Mr. Hayes Fisher, in reply, said that the President of the Local Government Board was strongly in favour of any economy that could be effected in this direction. He understood that in a very large proportion of the public lamps the candle power had already been reduced, but that in some cases the type of lamp employed was such that to reduce the candle power would involve a considerable amount of initial expenditure which would be thrown away in so far as it was not recouped by savings before the end of the war. He was informed that untreated lamps even of low candle power would not fulfil the main object of the regulations.

Artificial Manures.

Sir J. D. Rees asked the Parliamentary Secretary to the Board of Agriculture whether His Majesty's Government was considering the propriety of stopping the export of all artificial manures from this country, and of reducing the price at which sulphate of ammonia was supplied to farmers from £14 10s. per ton to some figure nearer the normal price of £10 10s.?

Mr. Acland stated that the export of all artificial manures was prohibited, and at the present time no licences were being issued except for certain quantities of sulphate of ammonia in excess of calculated home requirements. The matter of further restriction was under consideration.

Replying to further questions, Mr. ACLAND said it was not an easy thing to fix prices. The figure now quoted was £16 15s. per ton.

British Gas Undertakings in Germany.

In the "JOURNAL" for Dec. 28 (p. 711) two questions were published, of which notice had been given by Mr. King. Regarding the first, Mr. PRETYMAN said he understood that the arrangements for the transfer of the Frankfort-on-Main gas undertaking were submitted to Parliamentary Counsel and received his approval. Replying to the second question, Mr. RUNCIMAN said that he was aware that large amounts of British capital were employed in the manner stated. Arrangements were made last June for the registration with the Public Trustee of particulars of British property in enemy countries and in territory in enemy occupation. Due consideration would be given to all the circumstances in any steps which may be taken with regard to enemy property in this country.

Standing Order Stage of Private Bills.

For the first time in living memory all the Private Bills to be considered by Parliament in the ensuing session are to be unopposed at the first, or Standing Orders, stage. There are only 28 Bills in all.

LEGAL INTELLIGENCE.

ASSESSMENTS AND INCOME-TAX.

An Edinburgh Appeal.

In the Lands Valuation Appeal Court of Scotland, last week (before Lords Salvesen, Mackenzie, and Cullen), there was heard an appeal by the Edinburgh and Leith Gas Commissioners against a decision of the Valuation Committee of the City of Edinburgh in fixing the yearly value of their undertaking at £76,932. The Commissioners claimed that it should be reduced to £72,190. The difference of £4000 odd was the amount of income-tax payable by the Commissioners upon the profits of the undertaking. The Commissioners contended that they were entitled to a deduction of income-tax as expenditure incurred by them in carrying on the undertaking; and that the true valuation of the concern for assessment purposes could only be ascertained after the income-tax had been deducted from the revenue of the undertaking. The valuation of the undertaking is made up on the revenue principle; and until the present year the Assessor had allowed the amount of income-tax paid by the appellants as a deduction in arriving at the valuation of the undertaking. The Assessor maintained that the income-tax was purely personal, and could not enter as an element into the valuation of heritable subjects. The Valuation Committee sustained the Assessor's valuation; and the Gas Commissioners appealed. The Court, without calling on Counsel for the Assessor, affirmed the decision of the Valuation Committee.

Lord SALVESEN said the question was whether in valuing the gas undertaking the Gas Commissioners were entitled for the purpose of ascertaining the annual revenue to deduct from their net profits the amount of the income-tax levied under Schedule D. The only really strong argument presented was that there had been a consistent practice in the past on the part of Assessors to concede this deduction. From one point of view, this was a very strong argument, because Assessors applied their minds to these questions with a great deal of knowledge and considerable experience; and one would presume that a rule which had been established by practice would have a basis in law. But it happened from time to time, as the law in the matter of valuation developed, that they found a practice which had been consistently adhered to had nevertheless been decided by the highest tribunal to be wrong. No better instance of this was to be found than the case of the assessment of public sewers, which was established by the House of Lords, after something like fifty years of contrary practice, in which all the Assessors throughout the country had concurred. Practice did not go a very long way when the point had not been raised in Court. Now that this point was raised, it seemed to him very clear that they could not, in fixing the revenue of an undertaking for the purpose of settling the annual value of the subjects, deduct from the revenue a tax which was assessed upon the revenue. The undertaking had to be assessed upon the revenue principle. The Court had to ascertain what the revenue would be; and in ascertaining what the revenue would be, it seemed to be a contradiction in terms to say that the revenue should suffer the deduction of the amount of income-tax which the Government levied, and which might vary from year to year according to the requirements of the Government.

The other Judges concurred.

Fraud on the Derby Gas Company.

Godfrey Jenkinson, who had been discharged from the employ of the Derby Gas Company as a motor lorry driver, was sentenced by the Borough Magistrates on Monday of last week to three months' imprisonment, for defrauding the Company, by calling at houses, representing that he had been authorized to collect the "gas money." The amounts involved were relatively small; but the impudence of the prisoner, against whom there was a previous conviction for larceny, consisted of his making use of keys which he had procured from the Company's storeroom before leaving their service. In two cases, his attempts had been frustrated by the circumstance that the keys would not fit. Prisoner, who pleaded guilty, suggested that he was under the influence of drink when committing the offences.

Messrs. James Miller, Son, and Co., of West Nile Street, Glasgow, announce that they have terminated their agreement with the Berlin Aniline Company, Limited, whose sole representatives for Scotland they have been for almost forty years.

MISCELLANEOUS NEWS.

POSITION OF THE WIGAN GAS UNDERTAKING.

Sir Corbet Woodall's Report.

Gas matters occupied a considerable share of attention at the last monthly meeting of the Wigan County Borough Council; reference being made to the report of Sir Corbet Woodall, who had been called in to advise the Gas Committee as to the position of the undertaking.

Mr. FARR, in proposing the adoption of the minutes of the Gas Committee, called attention to the report of Sir Corbet Woodall, who, he said, had visited the works. The report contained many valuable suggestions, and it showed that the undertaking had come through the examination very well indeed. Though the plant was perhaps antiquated, it had been well cared for, the best had been got out of it, and the amount of gas obtained per ton of coal carbonized compared very favourably with more up-to-date plants. The report confirmed very largely the one prepared by their own Engineer (Mr. F. Betley), and completely endorsed the need for mechanical stokers, as suggested by the previous ex-Chairman. Other suggestions were made which, if carried out in full, would require an expenditure of between £20,000 and £30,000. The Committee decided that such an expenditure was hopeless at the present time, and had resolved to do that which would give most benefit to the undertaking without incurring any very great expense. They had come to the conclusion that nothing would help more than increasing the pressure over the whole system. By doing this, they would have a better supply, especially in the out-districts, and they would make better friends of their customers; while it would lead to a largely increased output of gas. The Committee would have to be prepared for a greater percentage of leakage, which was a very important thing in a town like Wigan, though looked at as a whole the increased pressure would be advantageous to the consumers. It was suggested that the 16 and 18 inch mains should be replaced by 24 and 30 inch ones; and a booster plant with fan to force the gas into the holders would give increased pressure on the larger volume passing through the mains. They would require a new condenser; and they were also advised to complete the second unit of the carburetted water-gas plant. Another thing suggested was the overhauling of the retort-house, the installation of mechanical stokers and conveyors, the improvement of the sulphate plant, and many other improvements which at present were not practicable. They had a small reserve fund; but on going into the financial position of the undertaking, he was shocked to find that machinery which had been down 39 years was not yet paid for. There were still instalments to the sinking fund owing. He did not know who had control of the gas-works 39 years ago; but having got borrowing powers extending over 60 years, no doubt they thought they were being smart in tying a millstone about the neck of posterity. "We have the misfortune to be the posterity," he observed. The Committee were therefore faced with the question of superseded capital. Now capital to replace the old plant would amount to about £600; and if they were going to pay this out of the reserve, what was going to happen when they tackled the retort-house—which they hoped to do in a few years' time? They would have thousands of pounds of superseded capital to meet. They wanted to conserve their reserve fund as far as possible, and wondered whether the Local Government Board would sanction a loan with which to meet the expenditure, for (say) the short term of fifteen years, or allow them to go ahead with the work and, after the war, treat the matter as if the work had not been done. Several other towns similarly situated had been successful in getting informal sanction to do immediately pressing work, and for the matter to be considered after the war. When Sir Corbet Woodall's suggestions were carried out, they hoped to have a bright future, with a larger body of satisfied customers, and a greater output of the commodity the works were called upon to supply.

Mr. M'CURDY, in seconding the motion, said the report not only gave them a right lead with regard to the financial policy to be pursued, but pointed to them how to attain a high standard of efficiency. The report suggested the necessity of new retort benches, mechanical stoking plant, governors and booster fan, the completion of the carburetted water-gas plant, a new set of condensers, the replacement of the exhausters by others of larger type, reconstruction of the sulphate of ammonia plant, and concentration of, and the installation of, new, boilers. The expenditure requisite was entirely out of the question in these days of rigid economy; but Sir Corbet Woodall emphasized very strongly the point about increased pressure. Were this matter proceeded with at once, it would remove a serious cause of complaint. This, together with the completion of the carburetted water-gas plant, new condensers, and mains, would complete the work possible just at present. The final portion in Sir Corbet Woodall's report was most valuable. In September last, when discussing the raising of the price of gas, he mentioned the huge sum which had been paid out of unearned profits for the relief of the rates, and he urged that the high price of gas was caused by the strain on the plant at the gas-works having been too great. He was glad his remarks had been amply vindicated by the report, which stated: "The fairly considerable works now calling for execution should have been dealt with in detail in past years. The amount spent annually upon upkeep of works, plant, &c., has not been sufficient; and consequently you have now to bear a burden, part of which should have been already carried. It is not for me in this report to discuss principles which should determine the distribution of profits made by your gas undertaking. One thing is, however, clear, and should be faced by the Corporation—namely, that no balance to the credit of a revenue account can be called, and dealt with as, profit so long as the condition of the plant is below a proper standard of efficiency. Within the past ten years £100,000 has been allocated from gas revenue to purposes in which the gas consumers, as such, have no special interest. This is in addition to the ordinary municipal rates. The policy so indicated should be discontinued until the property is brought to a satisfactory standard of efficiency—a suitable method being probably the creation of a suspense account, to be liquidated over a number of years." It was no use indulging in any recriminations over the past. What had been done or what should have been done would have no influence on things as they now were. But they ought to turn to a new page in the history of the undertaking. The Council as at present constituted would not allow them to go back to the policy of their predecessors. He felt that it would not be many years before they were able to bring the plant to such a high state of efficiency as would make it one of the most successful business departments of the Corporation.

The minutes were adopted; and it was decided to apply to the Local Government Board for sanction to borrow £5505 to carry on the work immediately decided upon.

GAS MATTERS AT STOCKPORT.

Various topics relating to gas manufacture and distribution were touched upon at the monthly meeting of the Stockport Town Council last Wednesday.

Mr. FERNS asked the Chairman of the Gas Committee (Mr. J. Winter, J.P.) to make a statement with regard to the number of recent complaints as to the quality of the gas. The "fault," he believed, arose from the inability (through the war) of the Gas Department to get the material they wanted to give the proper quality or quantity. He thought it would be an advantage if consumers knew the difficulties the Gas Committee had to contend with. They were doing their best, and under the special circumstances the public should be asked to put up with things.

Mr. STOCKTON said, from a business firm's point of view, he hoped the illuminating power of the gas would not be further reduced.

The MAYOR (Mr. T. W. Potts, J.P.) asked whether the gas supplied for cookers was affected. Complaints had been made at his residence that sufficient heat could not be obtained from the cookers.

Mr. WINTER said it must be admitted that for the last few weeks the gas had not been as good as it ought to be. This was accounted for by the fact that some had escaped into the holders without going through the purifiers. The Gas Engineer (Mr. Meunier) was at present endeavouring to remedy the fault; but in order to bring about a satisfactory result, the works would have to close-down for 16 to 24 hours. At a time like the present, it was impossible to do this. He asked the Council and the consumers generally to "bear with the gas" until, in a week or two, a remedy could be brought about. With regard to the lack of pressure, this was due to the fact that, owing to the decline of labour, they were compelled to conserve as much gas in the holders as possible. During the present short days, there was a great demand for gas; and they could not allow it to go out as freely as they would like to, because they were already hard-pressed to cope with requirements.

The Gas Engineer having reported at the last meeting of the Gas Committee upon the difficulties he was experiencing with regard to the cartage of coke, stated that he proposed to get the local bye-laws waived in order to allow one carter to take charge of two horses and carts. The Council confirmed the minutes of the previous meeting of the Committee, at which the Engineer also reported that, on account of the scarcity of labour, he had been using more oil. Coal deliveries were reported to be "very bad, except in the case of two contractors."

MANCHESTER GAS-METER TESTING DEPARTMENT.

Report of the Justices Committee for 1915.

At the Annual Meeting of the Justices of the Peace for the City of Manchester, on Friday last—the Lord Mayor (Alderman Copeland) presiding—Colonel H. T. Crook, D.L., M.Inst.C.E., submitted the annual report of the Justices Committee on the Gas-Meter Testing Department, London Road, Manchester.

After stating that the Inspector (Mr. S. Dyson) and employees of the department had continued to carry out their duties in a satisfactory manner, the Committee say: "A few years ago the Manchester Corporation Gas Committee decided to have all meters re-tested which had been in use for a period of ten years. About 70 per cent. of the meters which were submitted for re-examination were rejected for various causes, but chiefly owing to incorrect registration or from their having ceased to register, which was the case with a considerable number. Recently the Gas Committee decided to have the meters re-tested which had been in use seven years or upwards. Since this was decided upon, 1612 meters have been re-tested; and 568 only were found to be correct, which clearly proves that it is essential that there should be an examination of all meters which have been in use even for a shorter period than seven years. This has been the contention of the Committee for many years. One of the meters re-tested was a five-light wet meter which had been examined and sealed as being correct at the Committee's station nineteen years ago—that is, six years before the index-test was instituted. Upon applying the tests required by Statute, it was found to be registering 2 per cent. fast, and the index proved to be registering a further 40 per cent. fast. In October, the Chairman and Deputy-Chairman of the Birmingham Justices' Gas-Meter Testing Committee visited the station for the purpose of making inquiries regarding the methods adopted in Manchester for testing gas-meters; and they were much impressed with the thorough and complete arrangements for carrying out this work."

Increased Wages at Keighley.—In connection with a recommendation of the Gas Committee that the wages of gas-works employees should be increased, Alderman Smith informed the Keighley Town Council that the question had been gone into with the men and a representative of the Union; and the increase had been accepted verbally by the Union. The concessions would mean between £900 and £1000 per annum. A portion of the new carbonizing plant was now in operation; and it was proposed to increase the public lighting at once, by putting into use 850 lamps, instead of 217 as at present.

DIFFICULTIES AT PERTH.

Breakdowns in the Gas-Works Plant.

Since the advent of 1916, the officials at the Perth Gas-Works have, as is reported in the "Scotch Notes," experienced considerable difficulty with the plant at the works; and the subject has received the close attention of the Gas Committee. Last week matters reached an acute stage, when the plant broke down in several places, and the output of gas was found inadequate to meet the consumption. On Friday evening, a special meeting of the Gas Committee was held to discuss the situation. Ex-Bailie Wright, the Convener, presided, and the proceedings lasted for three hours. It was intimated that Mr. Duncan, the works foreman, had tendered his resignation. The Engineer and Manager (Mr. David Vass), who had been asked to furnish a report on the causes which had led up to the hitch, submitted his statement; and he was instructed to take steps to secure a new foreman. A Special Committee were appointed to co-operate with him in the close supervision of the works.

Mr. Vass's report upon the matter (which is dated Jan. 4) was in the following terms:

I regret that the opinion formed as to my ability to keep up the full pressure of gas has not been realized, in consequence of several unexpected accidents which have happened in close succession to each other. In my earlier report, I stated that, owing to the failure of our coal bucket elevator, we were entirely depending upon the hydraulic hoist, and that this was being taxed to its utmost. At 2 o'clock on the morning of Dec. 24, the hoist failed to work; and I turned out, along with the foreman, and renewed the valve-gear, and started it. But the foreman was called out a short time after, owing to it having failed again; the failure this time being due to a stoppage in the water-supply pipe of the hydraulic ram. We managed to get it clear; but the resulting delay caused a stoppage of the coal supply for working the stoking machines; and hand-charging was partly resorted to. We expected to make up for the loss of the stock of gas caused by this stoppage at the end of the week; but on the night shift of Sunday, Dec. 26, the combined stoking machine developed two electrical faults, and we could not get full work from it. The machine was partly wrought till daylight, when we procured the assistance of an electrician, and it was found there was a burn-out in the armature of the pusher motor of the combined machine. The armature was taken out and replaced by a spare one which we had in stock, and the machine was started after four hours' delay. The fault on the coal-charging motor could not be located, and was not discovered until two days later. During the time of replacing the armature, we began work with our spare pusher and hand charging; but the spare pusher also failed us, on account of a cast-iron bracket giving way. The retorts were consequently left uncharged during the replacing of the armature, as it was impossible even to draw by hand the charges that were in.

At 4 a.m. on the following morning we were again called out, owing to the combined machine having been seriously damaged by the machineman having started to travel along the retort-house with the ram partly extended. We were unable to work the machine, and consequently were unable to recharge the retorts until the damaged ram had been removed. The removal and replacement of the ram took in all four hours; and owing to the early hour of the breakdown there were no men available for working hand-charging, and retorts were left idle for the space of two hours at the withdrawal, and two hours later at the replacing of the ram. Hand-charging was carried on as far as possible. We were then reduced to the barest possible reserved stock, and might have carried through without serious reduction of pressure but for the accident to the hydraulic pumping engine. At 4 p.m. on the afternoon of Sunday, the engine broke down; and an examination showed two damaged cotter-pins. One of these was renewed and the engine again tried; but as it still failed to act, we secured the services of engineers in the town, and found a serious fracture of the barrel. It was not until 6 p.m. on Monday evening that the damaged part was repaired and the engine restarted. During the interval—*i.e.*, from 4 p.m. on Sunday till 6 p.m. on Monday (26 hours in all)—hand-charging was carried on continuously with all the men available; but the results produced by hand-charging were only about 50 per cent. of that obtained from machine work, with the result that at dusk on Monday we had only a very small stock of gas in the holders. The pressure was reduced as far as possible, but at 8 o'clock the holders were entirely empty.

The change-over from heavy machine charges to hand charges gave considerable trouble from the ascension-pipe getting stopped owing to the intense heat; and since resuming work with the machines, we have had considerable difficulty in clearing these pipes in order to get the full supply from the retorts. We have put on all the available men; and in the afternoon of yesterday we received assistance from the Surveyor's Department with a view to overtaking the work. There is only one mechanic in the works whose duty it is to give daily supervision to all the running machines; but this man has been off duty for the past fortnight through an attack of influenza. My foreman, Mr. Duncan, was off duty through illness for ten days during the time when we had our former difficulty with the failure of heating of the oven; and after each of the accidents recently he was laid aside for a shorter or longer period before we had fully got out of difficulty. He was on duty from 6 a.m. to 5 p.m. on the day following the visit of the Committee to the works, and promised to be back for a few hours later in the evening; But he did not return, and I received a report on the following morning that he was again ill in bed; and he has not since been back to the works. On Sunday, when we had our last breakdown, neither the foreman nor the fitter was available. Fortunately, I was on the works at the time and near to the engine when the heavy knocking took place, and had the engine stopped just in time to save the cylinder.

With so much running machinery in the works, it would be necessary to have more than one fitter available in the winter season at least, and all the machines would require to have a stand-by. It is quite evident that the hydraulic engine is being heavily over-taxed, and, as now constructed, is not a sufficient stand-by. The retort-house governors, which should assist materially in keeping a regular pull on the retorts, and so compensate for any variation in working, have not been working satisfactorily for some time past; and up to the present we have not been able to ascertain from what defect the trouble arises, owing to the plant being on full work. This search can only be made during the summer season. These accidents, and the considerable change in working arising therefrom, demanded very close attention in order to prevent a variation in the quality of the gas and to get a minimum yield of gas from the retorts in action; and owing to the absence of the foreman and mechanic, as before mentioned, this has entailed the constant personal attention on the works of myself on an average of eighteen hours per day during the period since the first breakdown.

The remainder of the parts for renewal of the coal-elevator arrived to-day; and the work of erection is being pushed on as speedily as possible. For pushing the coal we have already a spare pushing machine; but we have only one charging machine—that on the combined charger and discharger. This machine has given very little trouble up to now; but as it is running day and night in the winter season with an interval only from 5 to 15 minutes every two hours, it will be seen that we are incurring considerable risk in not having a stand-by with this machine also. When this machine requires a thorough overhaul, it can only be done in the summer season by resorting to the use of the West machines; and these would take several hours to re-erect and put into action, as there is no room for them standing in position ready for action while the other machines are working the full winter load. The West machines also require coal elevated to be available for work, so that they were of no service to us in the recent occasion.

We have had considerable difficulty in securing a sufficient supply of labour to cope with the extra work arising from the accidents, and even for labour for carrying on the ordinary routine of work. We usually have a few men with a little experience available in the yard for assisting in the retort-house when the full winter load comes on. But this season all the reserve men available for retort work have already been taken into the retort-house in the place of men off duty through illness; and some of the staff who should be on other duties had to be drawn upon to complete the retort-house staff. So the usual work of scurfing the retorts and attending to retort-house repairs cannot be undertaken for want of men; and this work is considerably in arrears. We have at present four men off through illness, and also two men absent without leave; and since the beginning of the year we have had other absentees. These absences from duty might not have been a serious matter in ordinary circumstances, but at present they are very serious.

In the afternoon of yesterday, through the kindness of a neighbouring gas engineer, I secured the services of two men experienced in clearing stopped pipes, to take charge of the gangs on the special work. We are now making progress in getting the pipes cleared; and to-day we have sufficient stock of gas to enable us to return to normal pressure. I hope to make further progress as the day advances; such as will admit of full pressure for the lighting period to-night.

I should perhaps explain that the capacity of the gasholders—a million cubic feet—is equal to the twenty-four hours' mid-winter output; but fully 300,000 cubic feet of this is drawn upon between the hours of dusk and 10 p.m., so that under the most favourable circumstances our reserve at midnight does not exceed sixteen hours' manufacture. Our usual minimum is 250,000 cubic feet of reserve, equal to six hours' manufacture, and our working average gives a reserve equal to about ten hours' manufacture; so that two stoppages of four hours' duration within one week leave us with very little reserve.

STOCKPORT ARBITRATION AWARD.

Settlement of Gas-Workers' Dispute.

At a Meeting of the Stockport Gas Committee held on Oct. 28, it was reported, in connection with the strike of workmen which occurred some time ago, that Mr. Lynden Macassey, K.C., had been appointed by the Board of Trade to examine and adjust the wages of the department, and that he had heard the evidence and arguments on behalf of the Gas Committee on the one hand and the Municipal Employees' Association on the other. The award is now issued.

By an agreement entered into in 1913, between the Gas Committee and representatives of the men, it was provided that if it were shown that better wages were paid to employees of the gas committees of comparable towns than were paid at Stockport, two practical persons should be appointed—one by the Committee and the other for the men—to examine and adjust the wages, so as to bring them, so far as practicable, into conformity with those of the towns adopted for comparison. By a further agreement entered into on Aug. 13 last, it was provided that the first agreement should be read, and have effect, as if the words "one practical person shall be appointed by the Board of Trade, under the provisions of the Conciliation Act, 1896," were substituted for "two practical persons shall be appointed."

At the hearing, the towns of Oldham, Bradford, Bury, Bolton, Manchester, Salford, Burnley, Rochdale, Blackburn, Leeds, Huddersfield, and Halifax were adopted for the purpose of comparison with Stockport. At the time of the hearing, wages for certain classes of men were satisfactory, and no claim was made in respect of them.

The Association claimed that other classes of employees in Stockport should be paid a rate of wages equal to the numerical average of the varying wages paid at the twelve towns adopted for comparison, without reference to the varying circumstances of the work and conditions prevailing at such towns.

The Arbitrator says: "I am unable to adopt this contention of the Union, and have, in fixing the rate of wages to be paid to the different classes of operatives in respect of whom an advance is claimed, considered the rate of wages payable to such class at each of the twelve towns. At the same time, I have had regard to the different conditions prevailing at each such town in regard to employment and work. After full consideration of the circumstances at Stockport and each of the twelve towns adopted for comparison, I order that the following shall be the rate of wages payable to the class of employee mentioned:

Hydraulic men	at the rate of	6¾d. per hour
Exhauster boiler men	,,	4s. 9d. per shift
Coal machine men	,,	7d. per hour
Coke wheelers	,,	4s. 6d. per shift
C.W.G. boiler men	,,	4s. 9d. ,,
Purifiers	,,	6½d. per hour
Works pipe-fitters, at the existing rate of wages, except that the lowest rate shall be		7d. per hour
instead of		6¾d. ,,
Crane-drivers and telpher men	at the rate of	7d. ,,
Jointers	,,	7½d. ,,
Labourers	,,	6¼d. ,,
Machine workers	,,	6¾d. ,,
Stove and meter complaint men	,,	7d. ,,
Stove cleaners and repairers	,,	6½d. ,,
Oilers and greasers	,,	6¾d. ,,
Meter inspectors, at the existing rate of wages, except that the maximum shall be		32s. per week
Lamplighters	at the rate of	27s. 7d. ,,
Gas-fitters	,,	8½d. per hour
Gas-fitters' labourers, starting as improvers:		
16 to 17 years of age	at the rate of	2½d. per hour
17 ,, 18 ,, ,,	,,	3d. ,,
18 ,, 19 ,, ,,	,,	3½d. ,,
19 ,, 20 ,, ,,	,,	4d. ,,
20 ,, 21 ,, ,,	,,	4½d. ,,
After 21 ,, ,,	,,	7d. ,,

Provided there shall be no reduction of the existing rates now paid.

The advances shall be paid as from the first full pay day next after Sept. 13, 1915.

At a meeting of the Gas Committee on Dec. 14, the Gas Engineer (Mr. S. Meunier) submitted a letter from the District Secretary of the Municipal Employees' Association with reference to the stokers' wages, and a number of communications that he had received from different branches of the workmen, stating that their cases had not been dealt with by the Arbitrator's award. The Committee resolved that the writers be informed that the Gas Committee "cannot depart from the terms of settlement; and that any portions of the award which are not satisfactory to them should be referred to the Arbitrator, through the Chief Industrial Commissioner (Sir George Askwith)."

The action of the Gas Committee was approved at a meeting of the Town Council last Wednesday; the Mayor (Mr. T. W. Potts, J.P.) remarking that it was satisfactory to hear the matter was now settled.

PRIVATE OWNERS' WAGGONS.

[From the "Iron and Coal Trades Review."]

The legal position respecting owners' waggons, apart from mineral and some other waggons, is very indistinct. The trader would appear to have no absolute right; and it is the absence of positive obligation which has proved the happy hunting ground of the railway lawyer. Under section 2 of the Traffic Act of 1854, the obligation of affording "reasonable facilities for the receiving, forwarding, and delivering of traffic and for the return of carriages, trucks, and other vehicles" was imposed upon the companies; and this enactment has been rightly regarded as the Magna Charta of the private waggon owner, inasmuch as the use of such waggons might fairly be claimed a reasonable facility. Every trader has the option of sending traffic in private waggons or in waggons supplied by the railway company [*vide* Sir F. Peel in *Harrison and Camm v. Midland Railway Company*, 1892]; and in that same case it was affirmed that, so long as a trader tendered goods in proper vehicles, he was entitled to have goods conveyed in those vehicles to the point of destination. So far so good. But the mere right to run waggons is altogether barren, unless it carries with it some advantages—financial and otherwise—to justify the purchase and the maintenance of the stock; and we are bound to recognize that legislation is sadly deficient on this point, and what is more the enactments in respect of it have been interpreted in a sense hostile to the traders' interest. The difficulty, fortunately, does not apply to traffic in class A, to certain traffics in class B, and to those products for which the companies decline to provide vehicles—viz., creosote, coal tar, gas tar, ammoniacal liquor, &c. In respect of these, the Rates and Charges Orders Confirmation Acts wisely fixed the maximum conveyance, exclusive of the charge for trucks. For other traffic, B to 5, however, the position is distinctly unfair and oppressive. The intention of Parliament was undoubtedly benevolent. Sub-section (*b*) of general condition 2 of the Acts of 1891-2 provides:

> Where, for the conveyance of merchandize *other than merchandize specified in class A of the classification*, the company do not provide trucks, the rate authorized for the conveyance shall be reduced by a sum which, for distances not exceeding 50 miles, shall, in the case of difference between the company and the person liable to pay the charge, be determined by an arbitrator appointed by the Board of Trade, and for distances exceeding 50 miles shall be the charge authorized to be made by the company for the provision of trucks, when not included in the maximum rate for conveyance.

These are:

50 to 75 miles	9d. per ton
76 to 150 miles	1s. per ton
Over 150 miles	1s. 3d. per ton

It will be noticed that this provision applies to traffic "other than in class A," and fixes the abatement. The obvious purport of the section was followed at first; and the meaning was so evident to the railway officials of the time that owners'-waggon rates were fixed in many instances. In fact, even in cases where the rates were exceptional—

below powers—figures were put on the rate-books in some areas with abatements for owners' waggons roughly as follows:

1 to 6 miles . . .	1d.
7 to 10 ,, . . .	1½d.
11 to 20 ,, . . .	2d.
21 to 40 ,, . . .	3d.
41 to 60 ,, . . .	4d.
61 to 80	5d.
81 to 100	6d.
101 to 120	7d.
121 to 150	8d.
151 to 200	9d.

This position, however, was not permitted to remain unchallenged, and traders were continually involved in disputes relative to their abatements, because the railway companies only granted them upon extreme pressure. Nor was the railway lawyer at a loss to find a flaw in the provision. The whole clause might be upset upon the interpretation of the word "provide;" and the opportunity came in 1911, when the Courts held that, so long as the companies were willing to provide trucks, the trader had no claim to a reduction from the tonnage (conveyance) rates under this section. If he claimed to run his own waggons as a "reasonable facility," he must run them for nothing. In consequence of this, the trader's right to use the railway under toll is now confined to class A traffic almost exclusively. The discouragement of the user of private waggons is not, however, confined to questions of rebate. Demurrage plays an equally important part. So far as legislation is concerned, the trader, under condition 6 of the Acts of 1891-2, was put into an identical position with the railways. It enacts that—

> Where merchandize is conveyed in trucks not belonging to the company, the trader shall be entitled to recover from the company a reasonable sum by way of demurrage for the detention of his trucks beyond a reasonable period.

Should he have the temerity to expect this provision to be honoured, he will probably experience immediate disillusionment; and should he go to the excessive cost of a law suit to enforce his claim, he may secure 6d. per day, as did Messrs. Charrington, Sells, Dale, and Co. in their fight with the London and North-Western Railway Company, in 1905, while for specially-constructed vehicles the companies may, as an act of grace, give 1s. per day after a very extended delay. Meanwhile, the companies exact in the reverse direction the following:

Ordinary waggons, 1s. 6d. per day.
High-capacity waggons, 2s. to 5s. per day.
Specially-constructed waggons, 3s. to 10s. per day.

And the Courts which award a trader 6d. per day have no hesitation in supporting the railway companies' claim to 1s. 6d. for identical detention.

AN EXPLOSION AT A BLACKBURN GAS-WORKS.

The members of the Blackburn Town Council had a long and stormy sitting on Thursday; one of the matters dealt with being an explosion which occurred at the Addison Street Gas-Works last month.

Mr. E. Porter, the local representative of the National Union of Gas Workers and General Labourers, sought to have an inquiry made by a representative Sub-Committee regarding an allegation that the explosion referred to was deliberately caused by the workmen themselves, or, in other words, by someone inside acting in collusion with someone outside. In moving an inquiry into the charge, of the falsity of which he was satisfied, Mr. Porter contended that it ought to be substantiated or withdrawn, as it placed the men under an undeserved stigma. Incidentally he remarked that he knew the man who had caused the explosion—not deliberately or maliciously, as he explained at a later stage of the proceedings—but he demurred to giving the name without certain safeguards. He went on to say that it was only reasonable, having regard to such serious charges, that there should be a full inquiry; for if the explosion was deliberate, it was a despicable act. The allegation was that a certain portion of the water-gas plant had been interfered with; thereby partially wrecking the installation and endangering the lives not only of workmen but of dwellers in the vicinity of the gas-works. The National Union of Gas Workers held the view that no punishment could be too severe for anyone who would stoop so low. On behalf of the men he was authorized to say that they were prepared to go before the Chief Constable of the borough, or anybody else, and give the whole of the evidence in their power.

Alderman Nuttall, J.P., the Mayor, who is also the Chairman of the Gas Committee, said that as he occupied the latter office he felt compelled to take part in the debate, or to say something. He hoped the Council would vote against the resolution. It was unnecessary to have an inquiry, because Mr. Porter had the information as to who had caused the explosion. He (the speaker) had nothing to withdraw from what was said at the Gas Committee meeting on Dec. 27. It was never stated that the explosion was caused by a workman, though it was said that the explosion was deliberately caused. The Union had issued to their members a pamphlet containing a number of letters that had passed between them; but it would have been better had they published the whole of the letters and not kept back those that did not quite suit them. He then read the following letter addressed by the General Manager of the Gas Department (Mr. A. Morton Fyffe, M.Inst.C.E.) to Mr. J. R. Clynes, M.P., the General Secretary of the Union. This showed clearly that the Gas Committee had dealt with the matter in a straightforward manner:

> *Dec.* 30, 1915.
>
> Dear Sir,—I am in receipt of yours of the 29th inst., and note what you say regarding the explosion which took place recently at our Addison Street works; and in reply thereto desire most emphatically to state that at no time have I alleged that the explosion was deliberately caused by some act of the workmen. What I have stated, and what I reiterate, is that the explosion was deliberately caused by the safety doors of the plant being tied down; but I have never at any time said that the act was committed by one of the workmen.
>
> The Gas Committee have put the matter in the hands of the police authorities; and if the person who is responsible for the explosion can be found, prosecution will follow.
>
> I would point out that the allegation that the explosion was caused by an act of one of the workmen has been made on behalf of your Union by Mr. Councillor Porter in his letter to me dated Dec. 21, in which he states that he knows how, and why, the explosion took place, and the name of the workman responsible.
>
> With this knowledge in your possession, you are enabled to enlighten the whole position by communicating the information to the Chief Constable of Blackburn, who now has entire charge of the matter.

Mr. Porter remarked, as he rose to continue the debate, "I hope the Council are now prepared for the details."

The Mayor, however, drew Mr. Porter's attention to the Standing Orders, and ruled him out of order; stating that, in his reply, he could not introduce new matter, but must confine himself to points raised in the discussion.

Three voted for the resolution and twenty-seven against.

GASHOLDER MISHAP AT HASLINGDEN.

An Effect of the Gale.

An anxious time was experienced by Mr. R. V. S. Houghton, the Engineer and Manager of the Haslingden Union Gas Company, during the gale which swept the country on New Year's Day, and which was the cause of an accident to the Company's No. 2 holder. In that part the storm was a terrific one, with wind travelling at an estimated rate of 100 miles an hour; and the holders, which are situated at the mouth of a valley, were exposed to its full force.

The holder in question is a two-lift telescopic one, about 90 feet diameter, with columns 50 feet high, and having a capacity of some 300,000 cubic feet. Mr. Houghton states that the cause of the accident [which occurred just after half-past five in the afternoon] was in all probability the cross-bars of the counterbalance chain attached to the outer lift, which, blown by the wind, hammered with great force on the guide-rail, eventually causing the fall of 10 feet of this from the top part of the column on to the holder crown below, through which it crashed into the tank. In its passage, this piece of guide-rail—which is 4½ in. by 6 in. T iron, 1 inch thick—pierced a hole, including jags, some 12 inches square, and also bent down and tore for a short distance the adjacent sheet, thus quickly liberating the 90,000 cubic feet or so of gas which the holder contained.

The consequence was that, at a most inconvenient time, a portion of the town was for about 20 minutes deprived of gas. Not a moment was lost, however, by Mr. Houghton in setting to work to put matters straight; the inlet and outlet of the damaged holder being promptly sealed-up, and the whole of the district supplied from No. 1 holder. With the aid of electric hand lamps, an effort was then made to ascertain the extent of the damage; but near approach to the holder was out of the question, a further fall of material being momentarily expected, for "the clash of the cross-bars of the chains supporting the balance-weights of the holder was like a series of huge hammers at work." Mr. Houghton was glad to find at dawn the following morning that only one sheet had been pierced; but as several other guide-rails had become loosened, the services of the fire brigade were requisitioned to lash these rails to the columns. By dint of assiduous work, a local tinsmith and his men succeeded in placing a steel sheet 5 ft. 7 in. by 1 ft. 8 in. over the pierced sheet; and Mr. Houghton had the well-deserved pleasure of seeing the holder again under pressure about half-past four on Sunday—less than 24 hours from the time of the accident. It is Mr. Houghton's wish to place on record his thanks to his Directors, the staff, and all who rendered help in connection with the untoward occurrence.

Belfast Gas Undertaking.

The "Northern Whig" (Belfast), in a comment on the working of the Belfast gas undertaking during 1915, remarks that "a puzzling factor is the merely nominal saving which seems to have been effected in the cost of public lighting by the very drastic reduction which has been made in the volume of street lighting." "Almost half the street lamps—save in one or two very central thoroughfares—were," says the writer, "out of commission during the greater part of the winter of 1914-15. Yet the amount of the saving in gas consumed by the street lamps up to the end of March, 1915, is recorded as £224 on an expenditure of upwards of £10,000. Most people would be glad if they could in their own private concerns increase their lighting in the proportion which the street lighting of 1913-14 bore to that of 1914-15 by an increase in their gas bills of a little over 2 per cent.! Surely the Committee has slipped somewhere in calculating the differentiation." The writer thinks the heavy proportion of oil or water gas seems fated to stay with the Belfast gas consumers. "Oil gas was," he states, worked up to nearly 50 per cent. in one supply—first on the score of saving space, although at the sacrifice of economy; the works being congested, and the oil gas, with coal at normal price, dearer to manufacture than coal gas. Now that the old works are being extended by the purchase of a considerable amount of adjoining property, the heavy proportion of water gas still stays with us on the score of economy; the very high price of coal and the comparatively low price we have been getting for our residuals making the oil gas cheaper than coal gas. The pity is that the amount of labour involved in oil-gas manufacture is so pitifully small compared with what is entailed in coal-gas production." Referring to the reduction by 2d. per 1000 cubic feet in the price of gas in October, 1914, the same authority argues that it was by no means warranted by the profits on the year's working. The subsequent increase of 4d., which took place last August, was, he observes, "a rude awakening from the fool's paradise in which the consuming public had been lulled. The most unsatisfactory part of the business is that almost every consumer complains of inflated gas bills; and many people whose lighting demands are steady and regular declare that their bills are considerably higher now than when gas cost 2s. 6d. per 1000 cubic feet net."

PUBLIC LIGHTING CONTRACTS AND THE WAR.

A Discussion at Reigate.

When the Reigate Town Council met on Monday night of last week, the Highways Committee reported that, as the result of negotiations between the Committee and the Redhill and Reigate Gas Companies and the Electric Lighting Committee, all the parties had agreed that there should be an abatement of £1 6s. per annum for each lamp not lighted, commencing on Oct. 23 last and continuing so long as the lighting restrictions remain in force. The Mayor had had a conference with the Engineer and General Manager of the Redhill Gas Company (Mr. W. H. Bennett), the Chairman of the Electric Lighting Committee, and the Electrical Engineer.

Mr. Handscomb moved that the whole matter be referred back to the Committee, as he thought the proposal needed further consideration—not that there was any doubt as to the ability and honesty of purpose of those who had dealt with the question. He said he would be prepared to accept the assurance that since the conference which had taken place between the parties further information had come to hand which, to his mind, made it necessary for the question to be gone into again. There were approximately 552 lamps ordinarily lighted by gas, of which 544 remained unlighted. The reduction would leave a sum of 34s. per lamp per annum to be paid on 544 lamps, or a total for the year of £925. What would the Council receive for this? Nothing, so far as the convenience and safety of the inhabitants were concerned. In dealing with the matter, it was interesting to know, without precedent in past experience, what was being done by other local authorities. In a borough somewhat like Reigate, no payment was made to the gas company. In another town, no charge was being made. So much for the matter from the point of view of the Council as the lighting authority. It should also be considered from the point of view of the Gas Company. It seemed only reasonable that some payment should be made for standing charges, which must continue, though the public for the time being derived no benefit from the lamps. It was only a question as to the reasonableness of the amount. In their case, they had to pay 34s. per lamp per annum. The highest payment elsewhere that had come under his notice was 13s. 4d. If Reigate were given similar terms, the amount payable per annum would be £362, or £563 less. In another district, it was 5s. 4d.; and on this basis the amount would be £780 less than was agreed upon. In another case it was to be 5s., or £789 less than the terms they were considering. These instances all related to local authorities in Surrey or Kent. He would quote another case, though it was much further afield. He referred to Ipswich, where the sum of 1s. per quarter was to be paid to the Gas Company for lamps not lighted. Though the difference between these sums and their own terms was so startling, he should state they had not been selected as the lowest ascertainable. If there was any other district in which the local authority had been called upon to pay more than the highest he had mentioned—viz., 13s. 4d.—it had not come under his notice. Possibly there were circumstances connected with Reigate which would differentiate it from all the other authorities to which he had referred. It seemed to him he would fail in his duty to the Council if he did not disclose the information in his possession; and he could but think that the Council would fail in their duty to the ratepayers if they did not refer the matter back for consideration.

Mr. Walter seconded the proposal to refer the matter back.

Alderman Barnes: Are we bound by our contracts?

The Mayor replied that he should say so. He did not think anyone could complain of the way Mr. Handscomb had brought forward the facts he had adduced; but before they were in a position to determine whether the cases quoted were suitable for comparison with Reigate, they should have before them the respective contracts. On Nov. 9, 1914, they entered into contracts with both Companies. They made what he considered was a favourable contract of £3 per lamp per annum for five years. This contract was entered into largely upon his recommendation. They had to bear in mind that the contract provided, not only for the supply of gas, but for lighting and extinguishing the lamps, and for the painting and repairs. The cost was £3 per lamp, or, reduced to simple figures, 1s. 2d. per lamp per week; and the Gas Companies were ready and willing to fulfil their contracts. It was no fault of theirs that they were not carrying it out. The Companies made the contract in the expectancy of obtaining some reward. The question was, having regard to all the circumstances, whether the difference between 6d. per lamp, which the Companies were prepared to rebate, and 1s. 2d. was sufficient. The 6d. rebate was a higher sum than he expected to obtain when he went into conference with the other parties; and it was a higher sum than the Town Clerk expected to obtain. They must not forget what were the standing charges—such as the decay of mantles and broken glasses, which were always more when the lamps were not lighted. There had been a great increase in the cost of glass. The Gas Companies met the Corporation very well indeed. He did not think they could expect them to make sacrifices, when there was no compulsion upon them to do so. They could come forward and ask the Corporation to carry out the contract; and without having the contracts of the other authorities before them, no useful purpose would be served by referring the matter back.

Mr. Handscomb: Was any information obtained or at hand when you met the Gas Companies?

The Mayor: No.

Several members having supported the motion, the whole matter was referred back for further consideration.

On behalf of the Mannesmann Tube Company and the United Tube Corporation, representations have been made to the Newport (Mon.) Corporation that the United Tube Corporation are entirely British, are controlled by Messrs. Baldwins, Limited, and are formed to carry out part of the original scheme of the Mannesmann Company, and, with the latter Company, are at present controlled by the Government, and are employing only British labour. The United Tube Corporation intend to expend about £50,000 in plant and machinery for carrying on the work.

GERMANY'S SUPPLIES OF NITRIC ACID.

[From the "Times."]

Interesting information arising out of the correspondence on the supply of nitrogen * and the possible diversion to the enemy of British exports of sulphate of ammonia was furnished to the "Times" with regard to Germany's ability to obtain supplies of nitric acid by synthetic processes from her own internal resources. Nitrogen and nitric acid are, of course, essential to the manufacture of high explosives.

The statement in a letter from Mr. D. Milne Watson (Chairman of the Sulphate of Ammonia Association) that the Badische Anilin Company now claim to be producing sulphate of ammonia at the rate of 300,000 tons a year, and that "in view of the increase in the production of cyanamide in Germany it seems more than probable that the German claim that they are independent of nitrogen from outside sources is correct," was discussed by Mr. A. E. Barton (Chairman of the Alby United Carbide Factories, Limited, and Nitrogen Products, Limited). Mr. Barton, who has just returned from a visit to Norway and Sweden, pointed out that the Badische Company's output of synthetic ammonia, which before the war was turned into sulphate, was 150,000 tons a year. There had undoubtedly been an increase; and he learned while in Scandinavia that this increase was about 200,000 tons, and that nitric acid was being produced by the use of synthetic ammonia. This, together with the output of certain smaller works producing nitric acid synthetically from gas liquor, was the chief source of Germany's nitric acid supply. If it were not for the Badische output, the supply of nitric acid would probably have given out long ago, as much must have been used up while the Badische Company were perfecting their synthetic process, which was not available before the war.

With regard to the future, Mr. Barton stated that he was informed that Dr. Caro, the inventor of the Frank Caro process of producing cyanamide, in conjunction with the Deutsche Bank, and backed by the Government, is installing at Bitterfeld, in Westphalia, a producer gas-power plant of 10,000 H.P. to make carbide of calcium, which can be turned into cyanamide, and the ammonia taken from this for the production of nitric acid by the synthetic process. It will apparently be possible to get ammonia as well as cyanamide from the producer-gas plant; and the result is expected to be the production of 200,000 tons of concentrated nitric acid per annum. In addition, there is another factory controlled by Caro and the Deutsche Bank, in Bavaria, producing about 30,000 tons of cyanamide, and the Knapsack works near Cologne producing some 15,000 tons also available, if necessary, for the manufacture of nitric acid. The new Caro plant was to have been running in January; but it is understood that there has been delay, and that it may not be ready for some time. Mr. Barton expressed the view that it is not necessary for Germany to get outside supplies to produce nitric acid, as there is enough ammonia available in the country for the purpose.

A fact for which business men who have visited Scandinavia vouch is that deliveries of machinery "to private order" are now being made to neutral countries from Germany. This would seem to indicate that the supplies of war munitions and materials are now such that owners of machinery works which were commandeered at the beginning of the war are being allowed to complete their private work and export machinery to neutral countries, which they were unable to do in the earlier stages of the war.

GAS LIGHTS A HUNDRED YEARS AGO.

Our attention has recently been directed to an article entitled "Process of Procuring Gas Lights," that appeared in the number of the "European Magazine" for January, 1816—just a century ago. The author is not named—the article being merely concluded by a "Z," and the date named. It will be interesting to reproduce it in its entirety.

This truly valuable modern discovery, now matured and brought to perfection by the combined efforts of several persevering individuals, stands pre-eminently conspicuous, whether considered in a domestic or national point of view, producing from smoke and refuse coal the most agreeable, silvery, and incomparable light, combined with the most powerful heat, whereby the interiors of shops and dwellings are rendered nearly as light as at noon-day, and the public streets and squares much more safe and convenient, even by one-fourth in number of lights, than by the common oil-lamps, which latter, by comparison, appear more imperfect and insufficient than ever.

This gaseous fluid is extracted by distillation; and the process I shall endeavour to render comprehensive to my readers.

A number of square cast-iron ovens, called retorts, are ranged, and fixed horizontally in brickwork, with flues passing under and over them. About a bushel of small coals is put into each; the doors are then screwed very tight, and secured by luting.

By external fires the retorts are kept intensely hot for the space of four or five hours, when the coke is taken out, and a fresh charge introduced, in which operation it is interesting to witness the effect—the door being unscrewed, the admission of atmospheric air causes ignition, and a very considerable report. This report can be almost destroyed by applying a light at the instant the door is opened.

From the upper side of each retort, a vertical, or rather syphon-like, pipe receives the gas and smoke in its gross state—with which, likewise, passes a portion of tar and ammonia into a larger horizontal pipe elevated, and thence continued, somewhat diminished, in an inclined direction, and immersed in troughs filled with water for the purpose of condensing it, to the chemical and purifying vessels, which are of cast iron, very large, and three in number. In the first of them is deposited the tar and ammonia—two products probably much

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* See "Journal" for Dec. 28, p. 717, and Jan. 4, p. 43.

over-rated in value. The utility of the latter is certainly not yet fully ascertained.

The gas disengaged now passes over by a double syphon-like pipe, partly immersed in water (condensing a quantity of essential oil, which passes into a receiver), into the second vessel, which contains a fluid composed of certain proportions of water and lime—in passing through which it deposits its sooty and sulphurous qualities. Again disengaged, it undergoes a second similar process in the third vessel; and now become transparent, the volatile fluid is conducted through another quantity of water, under the gasometers, in a distinct building.

The gasometers are immense vessels formed of plate iron closely riveted, suspended each by a strong chain, bottom upwards, which chain passes over two wheels, of large diameter, fixed in the strongly framed roof of the building, and kept nearly in equilibrium by ponderous weights at the other end of the chain. The shape of the gasometer is circular, on an oblong square—and some of those already formed will contain 25,000 cubic feet, and weigh nearly 10 tons.

Each gasometer rises and falls in a tank, somewhat larger, and of the same depth, filled with water. As the gas accumulates from the purifying vessels, it lifts up a certain weight or proportion of the gasometer, regulated by the equipoise, and which weight or pressure is necessary to give the required impetus, to force the gas into a larger outlet main pipe, likewise under the gasometer (the mouth standing a few inches above the water), which conveys it into the streets, and thence by smaller pipes into the houses.

As the gas diminishes in quantity, the gasometer sinks; and when nearly exhausted, care is taken to open the cock of the second, which if neglected, as has sometimes happened, all the lights are instantaneously extinguished. By this ingenious mechanism, no danger of explosion can be apprehended; for when the gasometer is raised to its greatest elevation, and can hold no more, the surplus quantity of gas finds vent through the surface of the water, under the mouth or rim of the gasometer.

The apprehension generally entertained of the explosion of gas is certainly not well founded; for, like water, it is equally under command. If conveyed in sound pipes, and directed by safe cocks, no danger can possibly happen. On the contrary, if the pipe, tube, or cock, should prove unsound, the gas would escape, and the room would soon become intolerable from the noxious effluvia—then by shutting the main cock, the cause would be removed. So, in like manner, when a water-pipe proves defective, feeling the inconvenience, we very naturally endeavour to shut off the water till the pipe can be repaired.

In the event of the breaking of the chain (more particularly liable in frosty weather), I certainly anticipate some unpleasant consequences. For the additional sudden pressure acting upon the gas, would probably impel the flame of every light to elongate very considerably; and if not immediately observed and counteracted by each commanding cock, might otherwise prove injurious.

I think it necessary to mention this circumstance, to prevent as much as possible the consequent alarm—bearing in mind the old proverb, that "prevention is better than cure." Hence the necessity of keeping anything combustible as far from the light as possible.

The quantity of gas daily prepared for a thousand lights, in the dark winter months, is immense, and, probably, far exceeding the calculations erroneously formed by experimental theorists. Hence arises the incompetency of the present establishments to increase, at present, the number of lights, and the consequent disappointment to the public desirous of being supplied, as likewise to the shareholder—doubtless deceived by the too sanguine prospects of wealth held out by the original projectors, and still continued by interested individuals, which, like many other speculations, so prolific of late years, has already decided by practice the fallacy of theory, as will be more particularly experienced in water-works, and, I fear, gas-light schemes.

To introduce the use of gas generally into shops, squares, and principal streets, the stations for the manufacture of it must be increased, both in number and magnitude, with the corresponding machinery and apparatus, and which are of the most expensive nature imaginable. The heavy disbursements in the first formation, and the casual and permanent expense of conducting such concerns, cannot, I am well convinced, be supported or maintained by the present inadequate rate of supply.

The coke produced, if not so valuable as coal, is certainly useful, and applicable to various purposes. The consumption of coke should be promoted by every individual interested, or wishing success to a useful discovery—so conducive to the interests and convenience of the community. It keeps a steady and clear fire, emits little smoke, therefore well adapted for bright stoves, and for chimneys inclined to smoke by particular winds; and will, in some degree, diminish the frequent necessity of sweeping chimneys.

The employment hereby given to a vast number of workmen, particularly in iron, copper, and brass, is deserving of particular mention, and has certainly proved a national advantage, in the stagnation of our commerce and trade.

The many beautiful and ingenious productions, in brass-work, now exhibited in the shops to show the lights to the best advantage, do great credit to the artists, and forms a new era in that particular branch of business.

Cardiff Water Supply.—The Cardiff Water Engineer (Mr. C. H. Priestley) has reported on the desirability of making provision for supplementing the supply of water from the Taff Fawr, not only when a drought is severely felt, but also when desirable at the commencement of a dry season. Last summer it was thought necessary to commence pumping from the Eley; and the cost of pumping 7¾ million gallons for the town supply was £180. Mr. Priestley considers that it should be possible, even during drought, to pump from 1¼ to 1½ million gallons per day; but this can only be guaranteed by having water from the Eley available when necessary. He suggests the utilization of existing pumping plant as far as possible; and it has been decided to adopt this course.

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Showroom Specialists for the Gas Industry

NOTES FROM SCOTLAND.

A Sudden Death in Edinburgh.—A painful sensation was created on Friday last in the Treasurer's Department of the Edinburgh and Leith Gas Commissioners by the sudden death of a member of the staff—Mr. David Dingwall. He arrived at the office, apparently in his usual robust health, but later in the morning complained of pain in the chest. Thinking a little fresh air would do him good, he left the office for a stroll. An hour had not passed before a telephone message was received from the police intimating that a body had been brought into the mortuary, and that in one of the pockets of the deceased's clothes was an envelope bearing the address "Gas Office, Edinburgh." Five years ago Mr. Dingwall met with a severe accident when motor cycling; and it is probable that this may have left some unsuspected weakness. He was 34 years of age, and unmarried.

Paisley Wages Increase.—The finding of the Board of Trade, to whom was referred the dispute between the retort-house workers in the Paisley Gas-Works and the Corporation, with regard to an increase of wages, has been issued. The Board recommend that the wages of the men concerned should be advanced by a further 2d. per shift, such advance to come into operation as from the beginning of the first full pay week following Dec. 17, and to be regarded as war wages, and to be recognized as due to, and dependent upon, the existence of the abnormal conditions now prevailing in consequence of the war.

Perth Gas-Works Mishap.—Last week hand stoking had temporarily to be resorted to in consequence of a breakdown in connection with the coal-handling plant at the Perth Gas-Works. With existing heavy demands, some difficulty was naturally found in maintaining a full supply of gas; and pending the putting in order of the mechanical arrangements, consumers were asked not to use gas for cooking and heating purposes, so as to conserve the supply to meet lighting requirements. Steps to have the necessary repairs executed with all possible speed were, of course, taken by Mr. David Vass (the Gas Manager). At a subsequent meeting of the Gas Committee, ex-Bailie Wright (the Convener) stated that the main cause of the present unsatisfactory position was the non-delivery of plant which had been under contract to replace a section of the stoking plant that had become worn out—the delay being caused through the works of the contractors having been taken over by the Government for munition work. It was expected that the renewals would have been made in the summer time. The defects which had recently occurred had now been remedied; and it was anticipated that there would be no further difficulty. He regretted that a breakdown should have occurred at this juncture, when the consumption of gas was at its maximum. The Committee agreed to ask Mr. Vass to submit a report in writing. [Since the above was in type, the text of Mr. Vass's report has been received, and is referred to elsewhere, p. 98.]

Gas-Furnaces in Glasgow.—Special attention is being devoted by the Glasgow Corporation Gas Department to the installation of gas-furnaces for annealing, tempering, and case-hardening, bolt and rivet making, and heating, shell nosing, shell banding, &c. All kinds of gas-heated furnaces are shown in the demonstration hall at the Gas Department workshops. The furnaces on view include types for melting copper, gun metal, brass, aluminium, &c., and drying ovens for japanning, lacquering, and similar work.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Jan.* 10.

A certain amount of business is being done in pitch; and with a little help from shipowners, good business might be possible. The present values range from 19s. to 19s. 6d. per ton net, at makers' works. Other values are: Creosote, 4⅛d. to 4¼d. per gallon in bulk; 90-160 solvent naphtha, 2s. 2d. per gallon naked; pure toluol, 3s. 4½d. per gallon naked—all at makers' works, net cash.

The demand for sulphate of ammonia still continues good, and values are very firm; £17 5s. per ton net into buyers' bags at makers' works being reported as having been paid for 25 per cent. quality for the first six months of this year.

Tar Products in the Provinces.

Jan. 10.

There is no alteration in the markets for tar products. Pitch is still quiet, and business is difficult to negotiate. The price of creosote remains the same. Heavy and light naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. 1d. to 2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 5d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Jan.* 8.

Although the number of transactions recorded this week has been comparatively small, the tone of the market has not diminished in vigour, and higher prices have again been paid at all points. At the close, the tendency is still upwards, and the nearest prompt values are £17 12s. 6d. per ton f.o.b. Hull, £17 17s. 6d. f.o.b. Liverpool, and

THE MAIN GAS FIRES.

The ST. NICHOLAS.

THE

ST. NICHOLAS—

The Gas Fire without a rival.

The new booklet—"Main Reflections"—contains particulars of several new Gas Fires. Copies free on application.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

£18 2s. 6d. f.o.b. Leith. For future delivery the attitude of producers has hindered business, and no first-hand sales have been reported; but it has transpired that middlemen have accepted a premium of 2s. 6d. to 5s. per ton on prompt prices for February-April shipment.

Nitrate of Soda.

This market is firmer on spot, and quotations have been advanced to 15s. 9d. per cwt. for ordinary, and 16s. 9d. for refined quality.

Sulphate of Ammonia.

From another source, it is stated that there has been little alteration in the market for this article during the past week, and not much fresh business has been reported. Outside London, makes are quoted at £17; Hull, £17 12s. 6d. to £17 15s.; Liverpool, £17 15s. to £17 17s. 6d.; Leith, £17 17s. 6d. to £18; Middlesbrough, £17 15s. to £17 17s. 6d.

[From S. W. Royse and Co.'s "Manchester Chemical Trade Review" for 1915.]

Tar Products.—Benzols were active; the full production being taken up readily, and supplies for motor purposes had to be refused. 50-90 was steady throughout at 1s. 5d.; and 90, after commencing at 9d., was steady at about 11¼d. since June. Solvent naphtha had a good year—advancing steadily from 9½d. per gallon to 2s.; and the market is strong at present. Creosote fell from 3¼d. in January to 2¾d. in July, and has since been steady. Production was heavy; and home consumption and export were less than usual. Shipments of creosote, tar oil, &c., during the eleven months of 1913 and 1915 were 34,495,414 gallons and 31,356,347 gallons respectively. Crystal carbolic makers were extremely busy—their full make being taken up at steady prices. Crude carbolic advanced from 3s. in January to 3s. 7d. in May, and has since been quite steady. Liquid carbolic acid has been continuously active; advancing from 1s. 3d. to 2s. 8d. per gallon. Pitch fell from 22s. 6d. to 17s. It did not lose much in the early months, but later had quite given way. The home demand was below normal, and export trade poor—the quantities during the eleven months of 1913 and 1915 being 434,179 tons and 233,214 tons respectively.

Sulphate of Ammonia was £11 17s. 6d. in January and £14 15s. in August, since when it advanced rapidly to £18, and is a strong market—a decreased supply of vitriol accounting largely for this. There is a good inquiry, both home and abroad. Exports during the eleven months of 1913 and 1915 were (respectively) 295,930 tons, value £4,031,918, and 278,520 tons, value £3,733,520.

It was reported to a meeting of the Colchester Town Council that the County Council had authorized the expenditure of £500 in opposing the Colchester Gas Company's Bill. The opposition will be formal; but it is pointed out that the county has jurisdiction over Colchester, so far as main roads are concerned.

COAL TRADE REPORT.

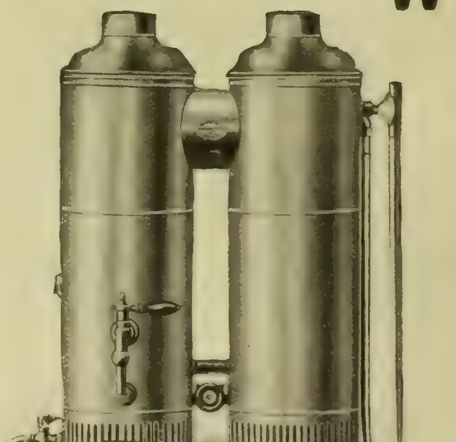
Northern Coal Trade.

The northern coal trade shows a strong demand. With much of the output taken up by contracts, there is some scarcity of fuel for ready delivery—indeed, many of the chief collieries are fully booked up to the end of the month, if steamers arrive in due course. In the steam coal trade, the prices seem to be fairly held; and the inquiry is very full for this time of the year. Best Northumbrian steams are from 23s. to 24s. 6d. per ton f.o.b.; and second-class steams are 20s. to 21s. per ton. Steam smalls vary from 10s. to 12s. 6d. per ton, according to quality, and with a steady demand. The gas coal trade is active, and the fuller output is readily taken up—in many cases to replenish stocks that were lessened in the holidays. Best Durham gas coals are from 22s. to 22s. 6d. per ton f.o.b.; second-class gas coals are 20s. to 21s. per ton; and "Wear Specials" are 23s. to 23s. 6d. per ton. There is still a high rate of freight quoted—23s. per ton having been paid, Tyne to Dunkirk. To Genoa, gas coal is about 22s. per ton for coal, and 70s. for freight. Contracts, however, often modify these figures; so that forward transactions are few. The stormy weather, too, delays steamers and makes the prompt market irregular in some cases, though the tone is on the whole strong, except where such delay causes an occasional ease in the price. Coke is firm; the exports having been heavier of late. Good gas coke is from 28s. to 30s. per ton f.o.b. in the Tyne. There are some advances in the local price of gas coke inland.

Bilston Gas Company.

Moving the adoption of the report and balance-sheet at the annual meeting, the Chairman (Mr. H. Holcroft) pointed out that the accounts were now under war conditions. Like most people, the Company had had their difficulties and troubles to face; but on the whole they had maintained their position fairly well. The sales of gas, in spite of adverse conditions, were approximately the same as they were in the previous year. Residuals, however, showed a considerable drop. The most serious item was the scarcity and the high price of coal. This had given much anxiety; but he thought he had been fairly successful in getting adequate supplies. They were not feeling the full increase in the price of coal in the present accounts because of the existence of old contracts, which, however, had now run out. The Directors hoped it might not be necessary to increase the price of gas. So far they had raised the charge only 3d. per 1000 cubic feet. They felt strongly that the lower in price they could keep the gas, the better it would be for the Company and for the district. It had been represented to him that, by extracting toluol from the gas, the Directors were not only depreciating the gas, but were getting a handsome profit at the expense of the consumers. This was far from the fact. It was a patriotic act on the Company's part, and not done for profit.

Mess Rooms, Canteens,
Works Kitchens, etc.



"The Duplus."

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Toluol and Ilkeston's Losses.

It was complained at a meeting of the Ilkeston Town Council last Tuesday, that the borough were having to pay somewhat dearly for their patriotism. The Mayor (Mr. J. A. Macdonald, J.P.), in moving the confirmation of the minutes of the Gas Committee, of which he is Chairman, explained that a communication had been received from the Department of the Minister of Munitions, stating that the Ilkeston Corporation had succeeded in improving the toluol contents of the tar at the gas-works; the percentage of toluol now furnished being most valuable. The Town Clerk had completed arrangements whereby the whole question of the effect of present Government demands on gas undertakings would be considered by the Association of Municipal Corporations, with a view to conjoint action being taken. As a result of carrying out the order, in their loyal desire to help the authorities, Ilkeston had already lost £500 upon the sale of tar. In addition, so as to improve the toluol, they had not obtained the same amount of gas, and were thus losing a further £200 a year. Naphthalene troubles had also been experienced; and he estimated the cost of extra labour involved at £100. So that they were losing anything up to £800 a year, which was considerable having regard to the size of the undertaking. It was their duty to carry out the orders which had been officially issued. At the same time, he hoped the Government would recognize that they had a sound claim on national funds for recompense for what they had lost. The Committee's report was adopted.

◆

Electric Light Failure in Leeds.—Much inconvenience, reports state, was caused on Monday of last week to Leeds shopkeepers whose premises are in the neighbourhood of the junction of Briggate and Upperhead Row, by a breakdown of one of the cables supplying electric light to their establishments. A fault in the main was discovered about 2 o'clock in the afternoon; and a body of workmen was thereafter engaged for some hours in trying to locate it. Light continued to be given up to 5 o'clock; but from that hour the current failed totally, and business had to be conducted by candle light up to the time of closing. About twenty shops were affected.

Gas Supply Difficulties at Chard.—At a meeting of the Chard Town Council last Tuesday, the Gas Committee recommended the installation of Horstmann clockwork controllers for the public lamps, discarding the pressure system now in use. It was complained that a certain factory was allowed to have a supply of gas when its electric supply failed, and that this was done presumably at the expense of the streets. Alderman Fowler explained that, had the gas not been allowed to the factory, the employees would have been prevented from working. It was also stated that the Gas Manager (Mr. A. J. S. White) had had to help with the stoking, owing to the shortage of men. At one time three men only were employed at the works; and the supply was stored up in order that the townspeople should have enough gas to cook their dinners. The report was adopted.

Quality of the Gas Supply at Exeter.

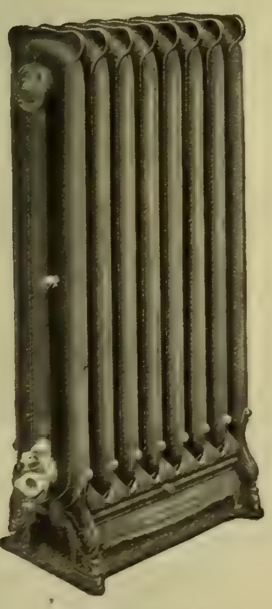
At a meeting last Tuesday of the Exeter City Council, Mr. Gayton called for a return of the illuminating power of the gas in the city. He said he was convinced that the public were not being fairly dealt with by the Company, more particularly those who used prepayment meters. He had noticed for some time that the gas given for 1d. had been lessened, and that the heating power had decreased. He did not think people objected to paying extra for the gas, if the heating power or pressure was equal to what it was before the war. Alderman Varwell said the Company kept as little above the standard of 14-candle power as possible. It was a low standard, but was fixed by Act of Parliament at a time when Exeter was proposing to buy the works. The Town Clerk explained that there was no statutory power as to the calorific value of the gas, though this was more important than illuminating power. When the Council opposed the Company's Bill in the House of Commons three or four years ago, this question was thoroughly threshed out in the Committee-room; but there were difficulties in the way of fixing a minimum. A communication had been received from the Minister of Munitions to the effect that, as gas companies were producing large quantities of toluol, some changes in the manufacture of gas were necessary, which diminished the illuminating power. Local authorities were, therefore, requested not to be too exacting upon gas companies about the preservation of the statutory minimum. The time was inopportune to press the Company for an increased standard, or even the preservation of the present standard. The motion was withdrawn.

◆

The Increase in Price at Elland.—It was stated in last week's "JOURNAL" that the Elland-cum-Greetland Gas Company had increased the price of gas 4d. per 1000 cubic feet, making it 2s. 10d. The price is advanced 4d.; but this brings the charge up to only 2s. 8d. per 1000 cubic feet.

Leeds Action on a Suggestion from the Mint.—The Leeds Gas Committee have decided to give a bonus of 2d. per meter to inspectors on all automatic gas-meters that they clear over and above their normal day's work. This is in consequence of a suggestion from the Master of the Royal Mint that the meters should be cleared at more frequent intervals, with a view to the coin being returned into active circulation as speedily as possible.

Increased Gas Charges at Kendal.—The price of gas to private consumers having been increased, the Gas Committee have recommended the Kendal Town Council to raise the price chargeable against the Lighting Committee, on the following revised method: The number of hours for lighting street-lamps according to the time table at present in force being 3222, any reduction in the number of hours of actual lighting shall be credited to the Committee at the rate of 0·135d. per point per hour. The annual charge per point of light shall be 36s. per annum for the full period of 3222 hours; being at the rate of 2s. 6d. per 1000 cubic feet.



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Supplied extensively for Heating Drill-Halls, Hospitals, Concentration Camps and Munition Works, and for other Military Purposes.

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AUTOMATIC VALVE: Free from mechanism; simplicity itself; and infallibility as well.

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These Radiators are quickly and cheaply installed and as easily removed, and are therefore specially suitable for heating temporary buildings.

ON HIRE WITH MANY IMPORTANT GAS UNDERTAKINGS.

ARDEN HILL & CO.,
Acme Works, Birmingham.

Gas-Engine Manufacturers and War Munitions.—At the Manchester Munitions Tribunal last Wednesday, a workman who stated that he was employed by a firm making gas-engines, applied for a certificate, on the ground that it had been unreasonably withheld. The employee stated that at the present time he was engaged in making engine-beds; and he wanted employment on war munitions. The firm were not represented; and the Chairman granted the certificate.

Alleged Tampering with Water-Works Machinery.—At a meeting of the Lathom and Burscough Urban District Council, allegations were made regarding supposed tampering with the Council's water-works. Mr. Studdart, in moving that mechanical experts be engaged to investigate the causes of constant breakdowns in the machinery at the water-works, and that no person be allowed at the works without signing the visitors' book and stating the reason for his presence, said that the number of breakdowns in the past twelve months demanded serious inquiry. He believed there was outside tampering with the works, and that there had been men there other than their own men. He wanted a military or police guard. The motion was unanimously carried.

Joint Tar Distilling Plants.—The "American Gaslight Journal" of the 27th ult. referred to the fact that English gas men are seriously considering the project of organizing two or three joint tar-treating plants, to handle the tar from neighbouring gas-works, as they seem to think that the tar-distilling concerns do not give them fair treatment, and that a co-operative plant to dehydrate, and perhaps distil, tar, would be profitable for the smaller undertakings. After mentioning that in Germany, most of the smaller gas-works are members of the Verband Deutscher Gas Fabriken, which has plants to treat tar and ammonia at several central points, and handle all the residuals of the member companies, our contemporary says: "A similar scheme here, or some other way to make a market for the small producer of tar, should be able to find a place in the industry."

High-Pressure in the Birmingham Gas Department.—In a message from the Birmingham Gas Committee to the employees, through the columns of the Department's Magazine, Sir Hallewell Rogers (the Chairman) says: "The year 1915 will be remembered by all of us as a particularly difficult and anxious one. The exceptional demand for gas, especially for munition purposes, and the shortage of labour, created additional responsibility for the various staffs, and necessitated increased vigilance and attention to duty on the part of every man. The output of gas by the department during the year has been increased by approximately 12½ per cent.; and bearing in mind that nearly 800 members of the department are now nobly serving their King and country in H.M. forces, the Committee realize that the progress and efficiency of the Department during the past year is due in no small measure to the painstaking manner in which the members of both the permanent and temporary staffs at the works and in the offices have worked. In addition to the 800 employees who are serving in the active forces, 650 men of military age have been attested in the army reserve."

Increase in Price at Hastings.—The Hastings and St. Leonards Gas Company give notice that the price of gas will be increased 3d. per 1000 cubic feet as from the current ordinary meter readings. In making the intimation, Mr. C. F. Botley (the Engineer and General Manager) says it will be understood that this alteration, "affecting, as it does, under the sliding-scale, both consumers and shareholders, is necessitated by the continued and unfortunate development of adverse conditions directly due to the war."

Dilatory Workers Fined.—Fines of 10s. each have been imposed by the Huddersfield Munitions Tribunal upon five fitters employed by Messrs. W. C. Holmes and Co., for leaving work at 8.50 a.m. on Dec. 29, and not returning until the following morning. The men at first said they left work because the shop was cold; but later they expressed their regret for what they had done, and said they did not realize the seriousness of impeding Government work. It was stated that the firm were engaged in making valves for British Dyes Limited.

Street Lighting at Shrewsbury.—Reductions in street lighting have already been made, with the result that the cost of lighting at Shrewsbury is £825 less; but a Special Committee appointed to suggest further means of economizing on town expenditure suggested that all street-lamps (gas and electric) should be extinguished at midnight—thus effecting a further saving of £376. When, however, the proposal came before the Council, it was withdrawn in favour of a motion that the lights should be extinguished at midnight for a month, as a test. This was defeated, so matters remain as at present.

Electricity v. Gas at Ilkeston.—In the course of discussion at last Tuesday's meeting of the Ilkeston Town Council, the Mayor said the municipal electricity undertaking had never paid—£10,000 having already been lost. Mr. E. Smith observed that the Mayor (who is Chairman of the Gas Committee) had promised them inestimable blessings from the work of the Committee, and, of course, he wanted to carry out his promise; but he was going too far when he attempted to veto what the Electricity Committee had done. The fact remains, however, that, while the tramways and electricity undertakings have proved unmistakable "white elephants," the gas concern, despite the disaster which occurred a few years ago, remains the only sound branch of remunerative municipal work in the town.

Lincoln Gas-Works and Coke Supply.—Complaint was made at the last meeting of the Lincoln City Council of the discontinuance by the Gas Committee of the practice of selling coke in small quantities to people calling for it at the works; Mr. Taylor asking if there was any real reason why the old system should not be reverted to. Alderman Wallis (the Chairman of the Committee), explained that, owing to the great quantity required by firms making munitions of war, there was comparatively little coke otherwise to be disposed of. They were doing their best to supply the bakers, and also sending a little out of the city to those who were their best customers in normal times. While reminding the Council that the gas undertaking was a commercial concern, he promised the Committee would do their best to meet the requirements of the poor.

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New Acid Concentration Plant at Manchester.—The Manchester Gas Committee have, the "Chemical Trade Journal" reports, entered into an agreement for the sale to the Ministry of Munitions of the concentrated sulphuric acid produced at the Bradford Road Gas-Works; and contracts have been placed for the supply and erection of three units of acid concentration plant at the works.

Metropolitan Water Board Deficiency.—At the last meeting of the London County Council, Mr. Meinertzhagen, answering a question from Mr. Gilbert, said the Metropolitan Water Board deficiency for the year 1914-15 was £94,873; and the estimated deficiency for the current year was £145,130. About four-fifths of the deficiency fell upon the ratepayers of London; and the amount for 1914-15 was equivalent to a rate of about 0·4d. in the pound.

Sidmouth Gas Undertaking.—At the last meeting of the Sidmouth Urban District Council, it was reported that the Gas Committee had received from the Local Government Board sanction to the raising of the further sum of £987 expended on the purchase of meters, cookers, mains, services, piping, and fittings for the prepayment installations. The Committee recommended that the Council contribute to, and become members of, the Sulphate of Ammonia Association; and that the salary of the Gas Manager (Mr. H. Burgess) be increased, and that he be granted a bonus for his services in connection with the extra work carried out last year, occasioned by the various extensions. These recommendations were approved.

Lighting of Bath.—Owing to Bath's situation, it has been found unnecessary to restrict the street lighting on military grounds; but recently the Corporation decided upon an economical scheme, by reducing the lighting at midnight. Arising out of this decision, at the last meeting of the Surveying Committee, the Chairman (Mr. A. W. Wills) submitted for formal record a communication from the Bath Gas Company giving the terms of the new contract. The restrictions reduce the cost of each single lamp by 12s.—£1 2s. each per year, as against £1 14s. formerly. Upon the proposition of Mr. W. J. Baker, the Chairman was heartily thanked for the trouble he had taken in the matter, and the Gas Company for the fair manner in which they had met the Committee.

Coal Supply Difficulties at Lymm and Warrington.—Several gas undertakings in Lancashire and Cheshire are experiencing serious difficulty owing to the shortage of coal. Last week, the Lymm District Council approved a resolution of the Gas Committee (passed a week earlier) that no new gas fires, cookers, or connections be supplied during the war, owing to the shortage of coal. The Warrington Corporation Gas Department have issued a notice to gas and coke consumers stating that, owing to the same cause, it may be necessary to reduce the supply of gas. At their last meeting the Gas Committee passed a resolution that "customers be only supplied, so far as possible, with quantities similar to their previous requirements, as taken upon the average of the quantities of coke supplied to them during the last five years."

Rise in Price at Kingston.—Increases in expenses in various directions, including freight charges and the cost of coal, oil, and other materials, have compelled the Directors of the Kingston-on-Thames Gas Company to notify an addition of 3d. per 1000 cubic feet to the charge for gas, making the price 3s. 1d. Previous to March last, the price of gas supplied by the Company had remained for a considerable period at 2s. 6d. per 1000 cubic feet; but at that date it was found necessary to raise it to 2s. 10d.

Morley Gas Undertaking.—The abstract of accounts of the Morley Corporation for the year ended March 31 last, just issued, shows that the income of the Gas Department was £20,505, and the expenditure £22,280; leaving a deficiency on the year of £1775. The main causes of the deficiency were the increased cost of coal and the transference of £500 to the district rate. Among the expenditure, coal accounted for £8572, purifying £169, carbonizing £1650, and repairs to works £734. Grants to employees totalled £26.

War Bonuses at Croydon.—The Directors of the Croydon Gas Company have decided that the war bonus hitherto paid shall be increased to the following scale: On wages of workmen earning not over 18s. per week, 1s. 6d.; over 18s. but not over 30s., 4s. 6d.; and over 30s. per week, 3s. The rates of wages will be taken at the normal weekly rates of pay, without overtime, and without deductions for funds, &c. No man earning 30s. or less, without bonus, will receive more than 33s. in all. On salaries not exceeding £100 per annum before deduction for funds, &c., 7½ per cent.; and exceeding £100 but not exceeding £200, 5 per cent.

Price of Gas at Darlington.—A motion to reduce the price of gas was defeated at last Thursday's meeting of the Darlington Town Council. The motion was to the effect that the price should be lowered by not less than 3d. per 1000 feet to ordinary and slot-meter consumers. Mr. Best, the mover, said the price had been advanced 33⅓ per cent., and the quality reduced 50 per cent. Mr. Dixon (the Chairman of the Gas Committee) pointed out that the Committee were waiting for the figures to be made up to March 31, and for the fixing of new contracts, before re-considering the question of the charge to consumers. The majority against the motion was overwhelming.

Workman "Gassed" at a Munition Factory.—A lengthy inquiry was made by the Manchester City Coroner into the circumstances of the death of Henry Grave, who was "gassed" at Messrs. Armstrong, Whitworth, and Co.'s Openshaw works. Deceased was a hydraulic power house engine attendant, and had on several occasions complained of a strong smell of gas in the pump-house. After the occurrence there was a smell, but not greater than usual. Apparently, said a witness, the gas percolated through the flues connected with the gas-producers. This was the first fatal accident of this particular kind during the fifteen years he had been foreman. Another witness said that in spite of all precautions taken by the firm, it had not yet been found possible to eliminate the percolation. Plans have been passed by the firm, in order to expel the gases from the room, and prevent them coming through the soil. A verdict of "Accidental death" was returned.

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A Belfast Explosion.—At the monthly meeting of the Belfast Corporation, Mr. Wheeler denied a statement in the Electrical Engineer's report that a recent underground explosion among electric wires in Rosemary Street was due to a defective gas-pipe. As a fact, he said, the defect in the gas-pipe was caused by an imperfectly insulated electric wire. Alderman Craig said this was the third explosion of the kind that had occurred in the same thoroughfare, and each time the trouble was attributed by the Gas Committee to the gas-main, though it was really an electric wire which was at fault. Mr. Stirling recalled that a recent fire at Fisherwick Place arose out of a piece of electric work which set fire to a gas-pipe. Alderman Craig afterwards stated that he understood the Engineer admitted he was mistaken in attributing the explosion to the gas-pipe, and that it was really due to an electric wire.

Wakefield Water Bill.—At a public meeting at Wakefield, those present unanimously approved of the promotion of the Bill of which notice has been given, for various purposes in connection with the Corporation water undertaking. In detailing the proposals at length, Mr. George Foster (the Chairman of the Water Committee) said it was well known that, besides supplying pure water for the 55,000 inhabitants of Wakefield, the Corporation also supplied a large area outside the city. It was proposed to abandon the construction of the Booth Dean reservoir at Rishworth, for which powers had already been obtained. This reservoir would have cost at least £60,000; whereas under the modified scheme an additional 500,000 gallons of water would be obtained daily at a capital charge of only £20,000. It would have taken at least seven years to construct the reservoir; while the proposed scheme could be completed in two years. It was not intended to increase the catchment area.

Rochdale Gas Workers Demand Increased Remuneration.—At the monthly meeting of the Rochdale Town Council on Friday, further reference was made to the application some time ago by the National Union of Gas Workers and General Labourers for increases of wages to about 150 men, and for various alterations in the number of hours worked. Mr. Walker (the Chairman of the Gas Committee) informed the members that the National Union of Corporation Workers requested that the bonus now paid to members should be added to their wages. The original application of the National Union of Gas Workers would have involved an increase in the present wages of £886, in addition to the bonus, or a total of £1450. Part of this increase was due to the claim of certain men to be put on an eight-hour shift, and for the curtailment of the number of hours worked per week. The Committee did not think that the present was an opportune time for conceding the whole of these alterations, but rather that it was one when every citizen should put forth all his energies for the general welfare of the country. After carefully considering the applications, the Committee granted certain concessions which represented an addition to the wages bill of, approximately, £780 a year (of which £570 was already being paid in war bonus), leaving the net addition £210. The proposed increases were agreed to.

APPLICATIONS FOR LETTERS PATENT.

18,072.—Keith, J. & G., "Gas-furnaces." Dec. 28.

18,092.—Twomey, W. K., "Burners." Dec. 28.

18,128.—Mace, B. E., and A. G. Sutherland, Ltd., "Coin-freed gas-meters." Dec. 29.

18,154.—Adams, M. J., "Gas incinerator." Dec. 30.

18,161.—Ionides, A. C., jun., "Furnaces." Dec. 30.

18,205.—South Metropolitan Gas Company and Chandler, D., "Gas-furnaces." Dec. 31.

18,217.—Grenfell, J. G., "Fluid-pressure regulators." Dec. 31.

18,218.—Sefton-Jones, H., "Producers for water gas." A communication from the Dellwik-Fleischer Wassergas G.m.b.H. Dec. 31.

Wath-on-Dearne Water-Works.—At a meeting of the Wath-on-Dearne Council last week, a report was given of the first year's working of the new water extensions. During last year (when the new pumping plant was in operation), the consumption increased 9 per cent. The amount of coal consumed was 668 tons, as against 1460 tons in 1914—a saving of 772 tons. There was also a saving on wages of attendants at the pumping-station. For the first year's working of the new pumping plant, the economies effected could be represented at £593 in revenue and running charges. The pumping plant contract amounted to £2264; and a fifteen years' loan had been granted, and the money borrowed at 4½ per cent. The plant would pay for itself in economies effected before January, 1919, or in three years from now. The extensions, it was further reported, had been finally completed at a cost of £11,679, or £216 less than the estimated cost.

Oldbury Public Lighting.—At a meeting of the Oldbury District Council last Friday, under the presidency of Mr. J. W. D. Pratt, the Public Works Committee recommended that the following revised charges be paid to the Gas Department in respect of public lighting as from April 1 next, to include maintenance charges: Lamps not lighted, £1 per lamp per annum; lamps lighted, £3 5s. per lamp per annum. Mr. Davies explained that these revised charges were suggested by the Gas Committee to help them to meet the additional heavy expenditure that was being imposed upon them in connection with the manufacture of gas. There were in the Oldbury district 802 lamps, of which 380 would be lighted; and the revision of the charges would mean an increased expenditure on street lighting of £400 a year. The figures were put before the Public Works Committee, who felt that it was impossible for the Gas Department to continue to supply gas for public lighting at the old rates; and the revised charges would only show a small margin of profit. If there should be any material profit through the increased charges, the Gas Department had agreed to make some grant towards the relief of the district rates. The revised charges were adopted.

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At a meeting of the Haworth District Council last week, the Chairman, in reviewing the administration of the district, said gas was from 8d. to 1s. 6d. per 1000 cubic feet cheaper in the township than in surrounding places, water was charged for only at a nominal rate, and the general district rate was 1s. 3d. in the pound lower than any in the neighbourhood. He could not see the necessity for increases in any department in the coming year.

The Sutherland Meter Company, Limited, write: "The Directors, Messrs. G. E., J. F., & A. C. Wright, called an extraordinary meeting of shareholders, at which they expressed their wish to retire from the Board; and they put before the shareholders their recommendation that the vacancies should be filled by appointing as Directors Mr. A. C. Frost (General Manager), Mr. R. G. Wootton, and Mr. G. F. Birtles. The resolution was carried, and the Directors then held a meeting, when the new members were duly appointed and took over the control of the Company."

The San Paulo (Brazil) Gas Company, Limited, announce that the Canadian and General Finance Company, Limited, will in future act as their purchasing and transfer agents, and that the registered offices will consequently be removed from Caxton House, Westminster, to 34, Bishopsgate, E.C.

The fusing of a main circuit was responsible for the cutting-off of the electric current at Shrewsbury last Saturday week, just at a time when the shops and places of entertainment were busy. Picture houses had to close before the completion of their programmes; but the theatre was more fortunate, through being in a position to continue the performance with the aid of gas. In some parts of the town two hours elapsed before the current was restored.

Mr. J. Lord asks us to mention that he has resigned his position as Chairman and Joint Managing Director of the "Manchester Furnaces, Limited," and started a new Company under the name of "J. Lord, Limited," for the manufacture of gas-furnaces. He has taken over the whole of the Continental business of Manchester Furnaces, Limited, and at the present time is erecting furnaces for the French, Italian, and Belgian Governments. The offices of "J. Lord, Limited," are at No. 40, St. Peter's Gate, Stockport. A series of new types of furnaces is being developed by them.

STOCK MARKET REPORT.

The first week of the New Year on the Stock Exchange was decidedly gratifying on the whole, though not all markets were equal participants. Business was more lively than it had been for some time past, and the predominant tendency was cheerful to a marked degree. There was a slight check before all was finished—not unusual after a big rise—but recovery was apparent on the closing day. There was no pressure to sell—indeed, business would have been more plentiful if stock had been less scarce. The War Loan was firm on the whole, and Consols were better; and, having regard to competing attractions for the investment of money, the position was very fair. A welcome feature was the progress of Home Rails, which took a strong line all through the week. The American Market was weakened by special factors, but steadied before the wind-up. In the Foreign Market, the chief feature was the continued demand for the French Loan, which now commands a good premium. Some little profit-snatching in mid-week did it no harm. Japanese and Argentine issues were also in favour. South Africans had a very good time. In the Miscellaneous group there were many noteworthy points. In Rubber shares there was a regular rush, and the rise extended to the good, the bad, and the indifferent. The shortage of shipping enhanced values in shares, and armaments and oils were also on the rise. Bank shares materially advanced on the half-year's accounts—the soundness of the policy of a generous writing-down of securities being recognized. Among general topics, it may be noted that Exchequer Bonds are going well. Somewhat in competition with them came the New South Wales Loan, which was not altogether welcomed, and its full subscription (it is believed) is not expected. The issue of small Exchequer Bonds at the post offices opened yesterday—a good move; but whether the people will appreciate it remains to be seen. The Government scheme for dealing with dollar securities is criticized as being overlaid with costly machinery. The Exchange value of the German mark of 11¾d. at New York and Amsterdam is now down to 8½d. Business in the Gas Market is in a state of inanition. Only three companies were dealt in at all, and some issues had but a single bargain. In the Money Market, rates hardened materially.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 70½, ditto preference 75½, 76, Primitiva 2¼, South Metropolitan 78¾, ditto debenture 60½. On Tuesday, Gas Light ordinary 70¼, 70½, 70¾, 71, 71¼, ditto maximum 60, ditto preference 75½, 76, Primitiva 2$\frac{5}{16}$, South Metropolitan 78. On Wednesday, Commercial 4 per cent. 76½, Gas Light ordinary 70, 70¼, 70¾, ditto preference 75½, 76½, San Paulo preference 8¾, South Metropolitan 78¾. On Thursday, Gas Light ordinary 70⅛, 70½, 70¾, 71, ditto maximum 59½, ditto preference 76½, South Metropolitan 77, 78. On Friday, Commercial 4 per cent. 75½, ditto 3½ per cent. 75, ditto debenture 55, Gas Light ordinary 70½, 70¾, 71, ditto maximum 60, South Metropolitan 77½, 77⅞. On Saturday, Gas Light ordinary 71, ditto maximum 60¼, South Metropolitan debenture 60⅜.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
374,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	10	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
373,480	10	"	7	7/-	B 7 p.c.	15—15½	4 10 4	..
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Deb.	..	—	..
330,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
330,000	"	"	†11	55/-	Do. New	204—209	5 5 3	..
50,000	"	"	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	75½—76½
560,000	"	"	5⅓	46/8	Do. 3½ p.c. do.	103—105	5 1 6	75
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	55
800,000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200,000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	70—71¼
2,600,000	"	"	3½	3½	3½ p.c. max.	76—79	4 8 7	59½—60¼
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10	75½—76½
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	"	"	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	..
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7		B	146—148	4 14 7	
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 3	..
100,000	50	"	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	"	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 13 4	2¼—2$\frac{5}{16}$
499,960	5	June 26	5	2/6	" 5 p.c. Pref.	4¾—5	5 0 0	..
521,600	100	June 2	4	4	" 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	8¾
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	"	"	10	10	Do. B	222—224	4 9 3	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	77½—78¾
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60⅜—60½
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	135—138	5 8 8	..
742,275	"	"	6	6	B 3½ p.c.	115—117	5 2 7	..
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 3 7	..
108,075	"	"	5/17/3	55/1½	" C 3½ p.c.	110—115	5 2 0	..
852,000	"	"	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	"	"	6⅜	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Gas and Water Engineer. Mansfield Corporation. Applications by Jan. 18.
Outdoor Superintendent. Cheltenham Gas Company. Applications by Jan. 15.
Clerk. No. 6132.
Clerk and Collector. No. 6134.
Working Foreman. No. 6135.
Working Foreman. No. 6136.
Mechanic. Stretford Gas-Works.
Stoker. King's Lynn Gas-Works.
Stoker. Willey and Co., Exeter.
Stokers. Tonbridge Gas-Works.
Yardman. King's Lynn Gas-Works.

Appointment Wanted.

Commercial Traveller. No. 6133.

Plant, &c. (Second Hand), for Sale.

Gas Exhauster. No. 6137.

Plant, &c. (Second Hand), Wanted.

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Patent Licence.

Incandescent Mantle Manufacture. Haseltine, Lake, and Co., 28, Southampton Buildings, Chancery Lane, W.C.

Sales of Stocks and Shares.

Haywards Heath Gas Company. By tender. Jan. 14.

Meetings.

Commercial Gas Company. Cannon Street Hotel. Feb. 17. Twelve o'clock.
Tottenham Light, Heat, and Power Company. 689 High Road, Tottenham. Feb. 5. Three o'clock.

TENDERS FOR

Fire-Clay Goods.

Mansfield Gas Department. Tenders by Jan. 21.

Sulphuric Acid.

Littlehampton Gas Company. Tenders by Jan. 28.
Mansfield Gas Department. Tenders by Jan. 21.

Tar.

Littlehampton Gas Company. Tenders by Jan. 28.
Malvern Gas Department. Tenders by Jan. 16.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office recently issued the following order:—

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "Journal" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the Office to any neutral country.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1916 are reminded that this can only be done before the end of January.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

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VOL. CXXXIII., No. 2749.] TUESDAY, JANUARY 18, 1916. [68th Year.

EDITORIAL NOTES.

Gas Bills in Parliament.

We complete to-day our review of the Gas Bills that have been promoted for the coming session. Most of them have their individual and interesting features; and, taking them as a whole, they point to the lines of the gas industry's development, and of legislative needs. Speaking generally, Parliament has, when powerful interests are not brought to bear, been more pliant of late years in the matter of receding from laws, fashioned in other times and under other circumstances, relating to the gas industry. Conservatism is good up to a point, but not when it takes a hostile attitude in relation to the mutations brought about by time, fresh discovery, and advances within an industry, as well as in respect of external influences brought to bear adversely upon the industry. We had something to say last week regarding the statutory financial conditions under which gas undertakings are operating, and as to the modifications towards greater elasticity and opportunity that general circumstances now demand shall be extended to the industry. No industry can serve the nation and the public to the best advantage if it is kept in a worse state than other industries in respect of the provision of capital and loans. One cannot work if one is starved; and so the gas industry must be placed in as good case in every way as any other industry or commercial undertaking. However, we believe that, in the industrial and commercial renaissance that the war is producing, and that pictures for us a greater Great Britain fighting for and defending its own life and prosperity giving resources, Parliament now recognizes that there must be larger freedom, and that broader principles must prevail. Certainly, this must be so in an industry exposed to competition in all quarters such as is the gas industry, and yet an industry whose very operations (as the Government now realize through the war) are necessary in order to provide fundamental and therefore essential materials for several other industries.

A larger liberty there must be—in regard to finance, trading conditions, and the making of the best economic use of opportunities. In connection with the gas business, a frequent request to-day is for sanction to the making of differential charges without giving preference under like circumstances. In almost every instance, too, the illuminating power standard is being abandoned by promoters, and the calorific value one is being adopted. All through the Bills on this occasion, promoters have forsaken the complication of a margin in the standard, and have favoured a definite standard of 500 B.Th.U. (total heat test), with one exception—the Aberdare and Aberaman Company, who ask for a marginless standard of 475 B.Th.U. If we mistake not, they will get it, inasmuch as in 1914, in the Bedwas and Machen Act and in the Porthcawl Act, Parliament allowed a standard of 540 B.Th.U., with a margin of 12 per cent., which brings the penalty-line down to 475 B.Th.U. In both instances, the request was allowed on the ground of the uncertainty with the local coals of being able to work with safety to a 500 B.Th.U. penalty-line. In the case of residual products, too, the road of development is clear. The country would have been in unenviable condition to-day, if the gas industry generally had been boxed-up in the manner another industry desired, but which, with excellent judgment, declines to subject itself to statutory restrictions. In certain quarters, Parliament listened. Parliament must to-day be thankful that opportunity did not permit it to proceed further than it did in shackling the industry in the matter of free working and trading in gas residuals. The war and national necessity have compelled an expansion of both working and trading in residuals within the industry; and last year saw Parliament in cases hesitating to commit further mischief by pressing for the one-third restriction. Certain Bills deal with the new situation that has been created by the country's requirements; and Parliament must see that in this matter national resources are expanded and not limited. This is one of the lessons for the Government and Parliament that has come out of the profoundly ominous situation in which the country found itself not many months since in regard to the supply of high explosives; and we hope that the lesson will not be lost upon Committees this coming session. Freedom in this matter means greater national security and public benefit.

In the expanding opportunities of gas undertakings, the process continues of the larger absorbing the less, and service to the public thereby promoted. The Folkestone Gas Company are annexing the Hythe and Sandgate Company; the Uxbridge Company, the Eton Company; and the Aberdare and Aberaman Company, the Hirwain Company. This consolidation of interests is always succeeded by economic advantages, in which the gas consumers in the smaller areas materially benefit—at any rate, this has hitherto been the invariable outcome. In every way, the legislation of the times points to the realization of greater freedom being a necessary factor in modern progress and in enabling competition to proceed on terms of equality with other industries. Freedom also means a greater power of resistance where in the commercial struggle the heaviest pressure is felt.

Sulphate of Ammonia in War Time.

Everybody can sympathize with Messrs. Bradbury and Hirsch in the disabilities under which they have laboured in preparing their review of the sulphate of ammonia market in 1915. They have incomplete statistical information; and their explanations of the movements of the market are more or less matters of hypothesis, with interest imparted to them by the knowledge that there are few people better placed for bringing hypothesis fairly closely up to the line of actuality. The war has entirely displaced definiteness from the components forming the foundation for a report of this kind; and the conditions are unique and altogether fictitious.

For instance, the estimate of home production for the year is only presented as the most proximate figure, in the absence of positive returns that can be arrived at. The total is 423,000 tons, or 3000 tons less than in 1914, and 9000 tons less than in 1913. In producing 173,000 tons, gas undertakings are charged with having been responsible for contributing 3000 tons less than in 1914; 9000 tons less than in 1913; but 1000 tons more than in 1912. Iron-works are credited with having produced 16,000 tons—the same as the previous year—and shale-works with 58,000 tons, or 5000 tons less than in 1914. This decline in the latter's output is counterbalanced by the larger yield of coke, carbonizing, and producer gas plants—viz., 176,000 tons, compared with 171,000 tons. The point of interest about this figure is something that for years past we have seen approaching, and that is the time when the coke and carbonizing plants as a class would in the magnitude of production take place superior to gas undertakings. This has now happened—according to the computation, and for an exceptional year; for the 176,000-ton yield of the coke and carbonizing plants is more by 3000 tons than that of the gas undertakings. However, if pride there was in respect of being the superiors in point of production, then we can look for consolation to the last normal year's working—1913—and there see registered 182,000 tons as the total yield from the working of gas undertakings. But position in the matter of magnitude does not trouble us. What is more important is that the demand should be developed so as to keep pace with the whole supply; and we say frankly that, after the war, we do not see how this is to be done without very strenuous and persistent work, in view of increased competition. As Messrs. Bradbury and Hirsch remark, while it is possible now, with eighteen months' experience of the war, to adjust matters in respect of the sulphate of ammonia market to the current abnormal conditions, great readjustment will again be required with a reversal to peace conditions.

There is no possibility of judging on the data now presented what will happen hereafter. We depend on export business for the disposal of something like three-quarters of our home production. This is a very serious proportion. With Germany out of the running, things are fairly plain sailing and favourable, except in the matter of freights. But with all drawbacks to foreign business, exports were well maintained last year. They amounted to 294,308 tons of the total produced, being 19,000 tons less than in 1914 and 30,000 tons less than in 1913; but something like 7500 tons higher than in 1912. There are rather strong grounds for believing that dealers in Holland and Sweden were at one time acting as intermediaries in supplying Germany with British production, which helped to swell our overseas business; but our Government is now very properly exercising a more stringent supervision in this direction. The sugar-growing countries, too, were magnificent customers. When it is seen that (with Holland) Java, British Guiana, West Indies, and Mauritius took during the year 161,974 tons, which was nearly twice as much as in 1914 and the odd figures alone over 100,000 tons more than cover the combined shipments for any previous year, we have facts that should arrest attention. Japan was a very small purchaser during last year, partly owing to the prohibitive freights, and partly to other causes; and the United States also fell away considerably. But if Japan had bought as largely as in previous years, Messrs. Bradbury and Hirsch point out that there would have been, without question, a sulphate of ammonia famine, and prices would have gone ramping up to higher levels still. If, on the other hand, the sugar-growing countries had not come to our aid, sulphate of ammonia producers would have been in a very unpleasant position—there would have been a glut of supplies, and a slump in prices. A study of the figures shows how careful will have to be the handling of the future when Germany is again a competitor, with its gas, coke-oven, and synthetic processes all putting on to the market large supplies of sulphate. But there is, so far as portents can be read, favourable ground for belief that the stability of the market in the immediate future will be maintained—that is to say, while present conditions rule—and good prices will so long continue to be realized. That they will remain at the existing high level, however, is open to doubt, notwithstanding home requirements, including those for munition purposes. The reason for doubt is that Messrs. Bradbury and Hirsch fear that there has been somewhat heavy buying on an advancing market for early delivery; and, if this is so, there may be a set-back in prices when the summer months are reached. There is, however, the sulphuric acid question, which is becoming more and more acute, and which may affect production; and there are also great inducements to fertilize in view of the increasing demands of the world for foodstuffs. Nevertheless, it would, all things considered, be imprudent to anticipate that a figure of anything like £16 7s. 6d. per ton with which the past year closed, or the higher figures with with this year has opened, will pursue an uninterrupted course, unless demand outruns the available supplies. The past year will, however, stand out for the energy displayed by prices in ascending from what had come to be regarded as about a normal figure to the before-mentioned £16 7s. 6d. per ton, and an average for the year of £14 9s. 3d., for the equal of which we have to go back more than thirty years.

Nitrate of soda (to say nothing of other fertilizers, which on this occasion the reporters ignore) has also done well in regard to price, but not in the bulk of dealings compared with pre-war years. Germany and Belgium have been shut-out from the market, or largely so, except in respect to such quantities as could be obtained by the former by the back-doors provided by neutral countries; and, before the war, the two countries were considerable purchasers. But the available supplies to meet the demands of the year have been such that prices have also gone up; but still those ruling in October and at the end of the year are regarded as having been unduly inflated. Freights, of course, have had their effect; but, even allowing for this, there was no real justification for the prices obtained. There are large stocks that can be released; there are considerable quantities waiting an outlet from the Panama Canal which has been blocked owing to an accident. When the canal is re-opened, these stocks will be liberated, and the way will be opened to quick transport of further supplies. This being so, unless output is restricted (despite requirements for munition purposes), it will be impossible to maintain the values that have lately been commanded. To some extent this would react on the sulphate of ammonia market. On the whole, however, in regard to the latter commodity, there is reason for present congratulation. But under such circumstances, let us not forget the future.

Impolitic Legislation in France.

It is not an agreeable task to criticize in any way the doings of the Government of such a close Ally as is the French nation; but from information collected from one of our French contemporaries (as summarized in other columns), there is good ground for doing so in relation to matters affecting the public generally, and the (from our point of observation) French gas undertakings particularly. It was only on Dec. 28 (pp. 696, 703) that we were congratulating our colleagues of the gas industry in France on the very sensible attitude that the Government were taking in regard to the question of gas contracts and charges in relation to any (really immaterial) deterioration of town gas that might arise as a consequence of the extraction from it of a proportion of its benzol and toluol content. The Government very properly look upon this as a national service, the results of which, whatever their nature, must be borne by the public generally, and without in any way affecting contracts. While we were congratulating the Government upon taking this extremely politic legislative course, it now appears that at that very time the Chamber of Deputies had other legislation on the *tapis* which also affects gas undertakings, and which appears to us to have about it the characteristics of being impolitic, unjust, and loose. In the measures to which exception is being strongly taken, the Chamber of Deputies are proposing to deal with effects and not with causes; and obviously the methods of doing this have been framed without any consideration as to their consequences, apart from the special one aimed at. The machinery, too, which they are intending to set-up so as to carry out their object is of the most ineffective kind that could well be imagined for the purpose in view, and just of the sort that is more likely to result in decisions which will be distinguished more for their variety in degree than for their common sense. It is proposed that prices of commodities, including those for lighting and heating, shall be fixed; the intention, of course, being to protect the public against inflated prices. The object is right enough; but it should be sought by other means than in the comprehensive and drastic manner that is proposed by the Chamber of Deputies. Those upon whom will fall the duty of fixing prices are the Mayor, or, if circumstances so direct, the Prefect of Police, with the assistance of an Advisory Committee drawn from Chambers of Commerce and Agricultural Syndicates.

Gas undertakings deal with several commodities other than gas; and we cannot imagine, unless the local gas undertaking is a municipal possession, that the Mayor or the Prefect will not keep a stricter eye on the pockets of the public than upon justice to the gas undertakings. There will undoubtedly be considerable variations in the views of the amateur tribunals as to what is right or wrong in this matter; and decisions will, we are afraid, be partly swayed by other factors than legitimate circumstances. If they were really governed by the whole of the circumstances, there might not be any particular ground for complaint; but the chances are greater that they will not be than that they will be. As to gas, it seems to be thought in the Chamber of Deputies that the contracts prevent any variations being made in the charges. But if the Government have regard to the regulation of prices on one hand as a matter of justice, they ought also to see whether the extraordinary circumstances of the times do not warrant the contract prices for such a commodity as gas being dealt with, in order that, through high coal prices and extraordinary freight and transport charges, the very life may not be squeezed out of undertakings that are in these exceptional times doing their utmost to serve the public and the country well in more ways than one. If the Government are anxious to carry out some constructive legislation, they could not do better than look into the conditions of the gas undertakings which are so actually engaged in public and national service, and see that their position for maintaining effective work is in no way unnecessarily impaired. The legislation in question has not yet (according to our latest information) been confirmed by the Senate; and it is to be hoped it will receive very drastic amendment before it is.

The Government are also proposing to exercise control over the supplies of fuel by instituting a central body for the purpose, with sub-bureaus in all mining districts and at the various ports. It seems that even the coal secured by railway companies and gas undertakings are to come under the general supervision of the proposed organization. The Government must have a care that they do not do more harm than good so far as the latter are concerned. Anyone who has studied the coal position in relation to France can readily see that what is proposed is tantamount to beginning at the wrong end. Regulation of prices at home sources (such as are available) may be feasible; and an attempt to get easier terms from the British coal industry and better control of freights, home transport, and labour required in unloading and distribution, would be constructive means helping towards very greatly improving the position. The Government are certainly in these matters going to work in anything but the best way, and will be simply producing a large amount of discontent where mutual aid should exist. Certainly for gas undertakings with fixed prices for gas, the regulation of prices for secondary products, and possible interference with coal deliveries, will only make confusion worse confounded.

Standards for Factory Illumination.

There is one thing against which the lighting industries devoutly hope they may be protected as an outcome of the investigation by the Departmental Committee appointed by the Home Office, into the large question of the lighting of factories and workshops; and it is that there will be no attempt at a finical individual standardization of illumination for the innumerable processes and operations that go to make up British industry. There is danger in superfluity where enthusiasts in any particular line of work are concerned; and there have been signs more than once of this danger developing in connection with the inquiry into factory and workshop lighting, with the result that there have been disquieting visions of tables containing masses of prescribed values for all classes and orders of work. But there has always been the comforting reflection that, if any essay was made in this direction, the very immensity of the work that would be involved would be a fit and proper punishment for those who sought to launch upon the owners of factories anything more than the most general illumination standards. We have never been able to see that there was any reason or necessity for anything more than the latter; and the farther we go into the matter, and see the vast incomparability that exists all through the industries, the more hardened do we become against anyone who talks of trying to perform the miracle of making the more or less rough-cast and inharmonious circumstances of factories and workshops comply with an exactitude that can only be secured in the placid atmosphere and under the regulated conditions of the laboratory.

But whatever may once have been the aspirations in regard to an illumination prescription for every process and operation, those who have so aspired appear to be bending under the force and weight of actual circumstances. These circumstances in their variety alone are overwhelming; and they are, it seems to us, performing the good service of bringing the ultraist down to the practical level of considering the sufficiency of general prescriptions. Some indication of this was obtained at the Royal Society of Arts last Tuesday evening. The occasion was the reading of a paper by Mr. J. S. Dow, before the Illuminating Engineering Society, on "Some Principles in Industrial Lighting." We do not suggest that Mr. Dow ever has been an extremist in anything; but he is in close touch with the illuminating engineering movement, and knows well what some votaries of scientific illumination have placed before themselves as an ideal in this particular matter. It is interesting, therefore, to find him saying, after having examined closely a booklet containing figures issued a few years ago in America in regard to the illumination practices of various trades, that "one is "inclined to think that perhaps it is hardly necessary, with "our present knowledge, to attempt to discriminate quite "so closely as in this production between the requirements "of different operations." One notices that Mr. Dow is somewhat circumspect as to the manner in which he says this. Perhaps he does not want to tread on sensitive corns; perhaps he does not wish to anticipate any expression of view on the part of the Departmental Committee (which we hope will come from them in due season) that their investigation assures them of the impracticability and, in fact, the needlessness and uselessness, of doing more than prescribe illumination standards in the most general terms. Then Mr. Dow suggested that perhaps the rough classification contained in the recently issued code prepared by a Committee of the American Illuminating Society might serve as a useful guide. The code suggests that for storage, passageways, stairways, and the like, the minimum illumination should be 0·25 foot-candle; for rough manufacturing and other operations, 1·25 foot-candles; for fine manufacturing and other operations, 3·5 foot-candles; while for special cases of fine work a desirable illumination would be from 10 to 15 foot-candles. Mr. Dow suggests that almost all industrial operations might be classified under one of these heads, so far as the amount of illumination required is concerned, though he qualifies this by saying that merely specifying a certain illumination on the work is not sufficient to secure "adequate and suitable lighting." The illumination must also comply with the requirements in regard to uniformity of illumination over the working area, and avoidance of glare and inconvenient shadows. Mr. C. C. Paterson, of the National Physical Laboratory, also stated that the more one saw of factories, the more one was impressed with the view that it was not very necessary to have lighting tables, and that to specify a standard for rough and fine work would be sufficient, with the exception of such cases as work on any dark materials, for which a much higher illumination is necessary.

It is hoped that these are the indications of a tendency to workable general prescriptions, and away from an absurd individual specification for practically each and every process and operation. There is no necessity for anything of this kind, especially in these days when illumination, using modern types of lamps, is so cheap that in enclosed places a liberal illumination (liberal without glare) can be quite economically provided that will cover work in the categories of rough, fine, and superfine, as well as the optical requirements of individual workers. If the result of the labours of the Committee is the levelling-up of the standards of illumination for work to those mentioned by Mr. Dow, it will be an excellent one; for, as the third volume of the report of the Committee has shown, there exists in factories to-day such a variety of degrees of illumination for the same classes of work that if the high ones are right, then those below must be wrong, and the lowest ones exceedingly bad. The question of factory illumination, in view of diverse environment and conditions, is complex enough already. Therefore the simpler and more general the prescriptions of standard illumination can be made the better, and the more likely are they to be adopted. Multiplicity means confusion; and the easier the way is made to reform, the greater and quicker the accomplishment.

Naphthalene Experiences at Ramsgate.

Naphthalene, even with the "C" process in operation for the recovery of toluol from the gas, is occasioning no concern at Ramsgate; and the reason is explained in a short article by Mr. William Thomson and Mr. R. H. Ruthven, which appears on p. 139 of this week's issue. Two-and-a-half years ago, they adopted very simple and inexpensive means of dealing with what had been previously a very acute trouble. Apparatus is employed which atomizes a light hydrocarbon oil; and the gas is brought into intimate contact with it. A sketch accompanying the description is explanatory of the whole arrangement. "While we cannot claim," write the contributors of the interesting experience, "complete immunity from naphthalene troubles, yet with a reduction of from 350 to less than 20 in the weekly number of complaints, we think we have got the trouble well in hand." The testimony is highly satisfactory.

The Gas Consumer and Toluol.

In connection with the extraction from gas of benzol and toluol for munition purposes, there has lately been good cause for adopting the attitude that the gas consumer should be informed as to the part that he is individually taking, through his use of gas, in providing the source of something that is of inestimable value to our Armies and our Navy. So long as there was any mystery about the matter, and busybodies and agitators existed, so long the consumer would naturally believe, or be invited to believe, that he was being in some way deprived of value, though there might be no visual or other experience of any depreciation. As we have recently pointed out, this feeling had commenced to show itself; and it was quite time the consumers were told the part they were taking in making provision of essentials for the war, and yet how little, using gas in modern ways, they were being affected. In the "Daily Telegraph" and other papers yesterday, there appeared an article headed "Explosives from Gas. Appeal to Consumers. A Patriotic Duty." It is exactly what is required for the information of consumers; and we suggest that managers of gas undertakings should get it reproduced in every newspaper in their areas of supply. There is nothing in the article that can be of service to the enemy; for what the enemy does not know about toloul extraction from gas, we rather fancy, is not worth knowing. What has been done in this country has been, and is being, done in Germany; so what has to be done here is to make the utmost use of our larger resource in town gas supply. The article acknowledges how loyally the gas undertakings are working in this country; and it tells the consumers how they can show their patriotism and loyalty, by burning as much gas as possible instead of coal, and by, if there should be any slight inconvenience, treating it as an occurrence resulting from complying with service in a national cause.

Complaint and Profit.

On the point of complaint, and touching the notion that a few disturbers of the peace have been trying to promulgate as to gas undertakings making large profits out of the extraction of toluol from gas, the following is an excellent statement, and illustrates the general character of the article: "But, though the direct inconvenience to the public has been small, complaints have been made freely, and a certain suspicion seems to be entertained that the gas companies are extracting these products from the gas to their own profit and to the detriment of the consumer. Nothing could be further from the truth. The gas companies have in nearly every instance had to arrange for the installation of new plant; and their engineers have had to devote considerable time and energy to teaching the process. The sum-total of the capital outlay that has been voluntarily borne by the many companies working the process has reached a very large figure. The inconvenience to the consumer, as has been said, is in the great majority of cases unnoticeable."

A Fixed Rate.

A suggestion, the adoption of which, if it proved practicable, would be hailed with relief by myriads of harassed ratepayers who, under present conditions, find it a matter of impossibility to determine with any degree of accuracy what their future liabilities are likely to be, was lately made in a Liverpool paper by a writer signing himself "Surveyor." The matter dealt with is the rates question—"one which hits all classes, and often hits hardest the most deserving"—and the article was apparently prompted by rumours of an increase in the Liverpool rates. Pointing out that in the last dozen years or so the rates in Liverpool have advanced about 40 per cent., the author asks whether this increase is to go on perpetually, or whether it is not possible to fix a high-tide mark beyond which the rates shall never rise. A fixed comprehensive civic rate, which he urges Liverpool to adopt, seems to him to be a sane and businesslike suggestion that should be readily accepted by those in authority as the main road by which efficiency in civic administration is to be secured. It is, of course, an obvious fact that economy is being enforced in the home and in the business house, and in both cases it is found not only desirable but absolutely necessary to impose hard-and-fast limits on expenditure.

And Economy.

Some means may be found of applying the maximum expenditure rule in the case of our local governing bodies. Indeed, the statement has been made by a member who some years ago in the Liverpool City Council raised the question of a fixed rate, that the idea is successfully practised in many modern and progressive American cities. Judging from some of the discussions upon public lighting which get reported in the Press, one would be inclined to think that councillors had determined to make their first aim a curtailment in the expenditure of the ratepayers' money. Incidentally, the discussions sometimes tend to show that even economy may be too dearly bought; but that is not exactly what is now being considered. The point of "Surveyor's" article is that for the present year the rates should be got within such a figure as stringent economy would reduce them to; and that then the different departments should be told that they must adhere to this amount, so that it would be a fixed rate for years to come. Provided the rate were put at a sufficient figure to ensure efficiency, the system would possess advantages; for under prevailing methods the tendency of rates is so often upwards, and so seldom downwards.

Gas Consumption Figures in Manchester.

Reference has been made in the preceding paragraph to reductions, and proposed reductions, in public lighting which have been inspired by the desire to economize. But it must be remembered that there are a far larger number of places in which the illumination of the streets has been reduced on a drastic scale by order of the authorities. For instance, at Manchester, during the nine months ended Dec. 31, the gas consumed in the city and outlying places supplied by the Corporation shows a decrease of 2·88 per cent., compared with the corresponding period of 1914, when an increase of 3·11 per cent. was recorded. This decrease is regarded as being entirely attributable to the effect of the restricted lighting order which came into operation on March 1, because the records show an increase of 7·84 per cent. in the consumption of gas in the daytime, as contrasted with a decrease of 9·6 per cent. in the consumption between 4 p.m. and 8 a.m. In addition to illustrating the result of the restricted lighting on the consumption, these figures possess another significance pointed out by the Superintendent (Mr. F. A. Price). That is to say, they indicate a gratifying increase in the numbers of gas-consuming appliances in use. The books prove that at the end of last year there were practically 12,000 more cookers, grillers, and fires fitted than was the case at the close of 1914. This goes a long way towards off-setting the temporary restriction of the public lighting consumption. Labour has to be used sparingly at Manchester as elsewhere, and while the prepayment meters are attended to as frequently as possible, so as to release the coppers for circulation, a great saving has been brought about by reading the ordinary dry meters only once a quarter, instead of twice, as in normal times. Wet meters, however, as far as possible continue to be inspected twice a quarter.

Board of Trade and Gas-Lighted Trains.

The electrical interests, according to custom, are continuing to do their utmost to keep alive the question of supplanting gas lighting by electric lighting in trains, while defending the use of electricity in mines and other places, despite the heavy list of fatalities due to such use that has been produced the last few years. A question has been asked in the House of Commons as to what the Railway Companies are doing in the matter of conversion from one system of lighting to the other, in view of the recommendations of the Board of Trade Inspectors; and Mr. Runciman could only answer that the Railway Companies are effecting conversions on their long-distance express trains as and when opportunity allows. The position is one that is very unsatisfactory. The clamour over the matter is distinctly due to the initiation of interested parties, who have taken advantage of the recommendations of Board of Trade Inspectors, whose opinions have been formed on extremely doubtful evidence advanced by men who have "thought" or "believed" something or other on alleged observation at the time of the accidents. The "observations" made during the minutes following the shock, and during the height of the commotion and horror succeeding all such events when of a serious nature, cannot be of a very exact order, and therefore are suspect. The incandescent embers from the engines have been fanned into flame—and by some excited individuals into a gas-flame. These gas-flames have been seen burning as jets where gas could not have been owing to the severance of the connections at the cylinders. Gas too has been seen burning in other places, though cylinders have ugly openings in them through which the high-pressure gas would rush and be dissipated without doing harm. But with it all, it does not appear to have occurred to the Inspectors or to the technical advisers of the Board of Trade that some independent and competent persons of scientific standing, should be called in to thoroughly investigate what would happen in such cases—whether or not the gas under the conditions would be an active agent in connection with the conflagration. If this were done, we have confidence as to the result. Until it is done, the Board of Trade are not going to the extent they should do before bringing pressure to bear upon the Railway Companies as to incurring the heavy expense of changing from one system of lighting to another, and the heavy cost of lighting trains electrically, and before depriving the public of a reliable and good quality light, which is less injurious to vision than the light which prejudice and interest urge should supersede it.

Coal and Coke Exports.

The effect of the work of the Coal Exports Committee is markedly illustrated by the Board of Trade returns for December. Notwithstanding that France was a buyer of 1,386,299 tons of coal, compared with 1,246,786 tons in December, 1914, and 1,099,553 tons in December, 1913, the total quantity of coal exported during the month was 3,287,242 tons, or a reduction of 411,632 tons on December, 1914, though the quantity that left our shores last month was 57,789 tons more than in December, 1913, when Russia, Germany, Belgium, Austria-Hungary, Greece, Roumania, and Turkey were purchasers. Against them all are blanks for the past month. Several of the other countries, however, who were heavy buyers in December, 1914, show considerable reductions for last month—notable ones being Sweden, which is 120,000 tons down, and Italy, which is nearly 400,000 tons down. The amount of coke exported during the month was 101,168 tons; while in December, 1914, it was 107,442 tons, and in December, 1913, 118,619 tons. With the close of the year, it is interesting to bring into comparison the exports of coal, coke, and manufactured fuel the last four years. In 1912, the quantity of coal exported was 64,444,395 tons; in 1913, 73,400,118 tons; 1914, 59,039,880 tons; 1915, 43,534,771 tons. Therefore in comparison with 1913, the war year of 1915 exhibits a decline of 29,865,347 tons. The figures for coke are: 1912, 1,010,650 tons; 1913, 1,235,141 tons; 1914, 1,182,848 tons; 1915, 1,010,302 tons. For manufactured fuel, the figures are: 1912, 1,580,803 tons; 1913, 2,053,187 tons; 1914, 1,607,757 tons; 1915, 1,225,071 tons. Last year, France took approximately 5 million tons of coal more than in 1913.

Gas Heating of Bakers' Ovens.

The Central Gas Publicity Bureau of Berlin reports that a difficulty which, it states, has hitherto existed in the heating of bakers' ovens of the type heated by an internal fire or burner—due to the fact that the Méker burner, which has heretofore been generally used for heating them, requires a gas pressure of at least 18-10ths—has now been overcome. This statement is based on a report from Herr Kobbert, the Manager of the Königsberg Gas-Works, to the effect that Launhardt's gas-burner for bakers' ovens heats them perfectly at less than 4-10ths pressure. This result is, of course, only attained if the gas service and connection to the burner are sufficiently large. The burner shows much less tendency than earlier burners to light-back. The adoption of this burner in bakers' ovens in Königsberg has been one factor contributing to the increase in gas consumption there, which in the months of August, September, and October last was 76 per cent. greater than in the corresponding period of 1913.

Sulphate of Ammonia in Japan.—Gas companies in Japan have, according to the "Journal of the Imperial Gas Association," been awakened to the unwise methods hitherto adopted for disposing of gas liquor; and some of them are now preparing to undertake the manufacture of sulphate of ammonia. Among others installing plant are the Western Consolidated Gas Company, the Nagasaki Electric and Gas Company, and the Sendai Gas Company.

Society of Chemical Industry and the Pollution of the Atmosphere.—At a meeting of the Society of Chemical Industry held at the Grand Hotel, Manchester, last Friday, Professor Haldane Gee alluded to the subject of impurities in the Manchester atmosphere. He showed that the atmosphere, in regard to smoke, had been very much the same as at present for the past forty or fifty years. He compared Manchester with a number of other towns with respect to sunshine; and from this it appeared that Manchester had the lowest amount. Mr. R. H. Clayton (of Messrs. Hardman and Holden, Limited), who took part in the discussion, suggested that Manchester should have a municipal central hall, where, with a view to diminishing the smoke nuisance, the best apparatus for gas and coal heating could be exhibited, and also where examples of the effects of smoke on buildings, &c., could be shown.

PROJECTED GAS LEGISLATION FOR 1916 BY BILLS AND PROVISIONAL ORDERS.

[Third Article.]

This week we complete the review of the Gas Bills, and give notices of the two Gas Provisional Orders which have been lodged with the Board of Trade.

The Plymouth and Stonehouse Gas Company's Bill is one of the most interesting of the session. In the preamble it is submitted that the Company have for some years past carried on a considerable business in connection with the manufacture, utilization, and conversion of products arising in the manufacture of gas. Certain products arising in, or resulting from, the manufacture of gas and the distillation of tar are required in large quantities in connection with the prosecution of the present war; and the Company have, under the provisions of the "Munitions of War Act 1915," and at the instance, and with the approval, of the Minister of Munitions, taken steps to increase the output of such products, and with this object to acquire certain works and plant for the distillation of tar, and to provide other works and appliances. The Company have entered into an agreement for the acquisition of certain tar-distilling works in the county borough, and the business carried on in connection therewith now vested in the executors of Thomas Henry Harvey deceased. It is therefore expedient that additional powers should be conferred upon the Company with reference to the manufacture, utilization, and conversion of products arising from the manufacture of gas and the distillation of tar, and that provision should be made for the purchase by the Company of tar and other residual products from companies, local authorities, bodies, and persons supplying gas or producing tar within the counties of Devon and Cornwall, and also for the purchase by the Company of such products other than tar from other companies, local authorities, bodies, and persons. It is also expedient that provision should be made under which the business of manufacturing, utilizing, and converting such products may be carried on by the Company in co-operation with other companies, local authorities, bodies, or persons supplying gas or producing tar within the counties of Devon and Cornwall. Information is then given as to the capital of the Company, which now consists of 7000 shares of £10 each, bearing dividend at the rate of 7½ per cent. per annum; 3000 shares of £10 each, bearing dividend at the rate of 7 per cent. per annum; £188,120 ordinary stock, bearing dividend at the rate of 5 per cent. per annum. The Company have received by way of premiums on the sale of shares and stock £76,550; and they are authorized to raise a further sum of £75,330 by the creation and issue of ordinary stock. Under their Acts, the Company are empowered to borrow £123,333, of which they have already raised £69,347 by the issue of £50,000 of 3 per cent. debenture stock, on the sale of which no premium was obtained, and £20,000 of 3½ per cent. debenture stock, which realized on the sale £19,347. The Company have expended on capital account £447,952. The increasing demands for gas will necessitate further capital expenditure; and it is submitted that it is expedient that the Company should be authorized to issue debenture stock to the executors of the late Mr. Harvey as consideration, or part consideration, for the property acquired, or to be acquired, by the Company, and that for these and other purposes additional powers should be conferred with reference to the creation and issue of debenture stock. The first clauses of the Bill are to empower the acquisition of the land, works and plant, and business of Mr. Harvey, and to authorize the carrying on of the work of converting residual products, &c., in accordance with the proposal sketched in the preamble of the Bill. The Company also ask to supersede their illuminating power standard by a calorific value one of a level 500 B.Th.U., tested by the instruments and under the conditions prescribed by the Metropolitan Gas Referees. Power to the Board of Trade to make a triennial revision of the standard is arranged for; authorization to move in the matter being conferred on the Company, the Corporation, or the Plympton St. Mary Rural District Council. A large number of clauses common to all modern Gas Bills are included. Then there is the one to sanction the issue of debenture stock as consideration for the acquisition of the property from the executors of Mr. Harvey. The Company, however, propose that they shall be empowered to create debenture stock, including premiums and the consideration referred to, to the amount of £30,000. Finally, they desire to create and issue as redeemable debenture stock any debenture stock authorized by this Act or any unissued debenture stock authorized by their Acts of 1898 and 1903. They ask, too, for power to specify, in the resolution determining the issue as redeemable stock, the terms and conditions on which the stock shall be redeemed. Provision is made for the formation of a redemption fund. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The general lines of the Bill promoted by the South Metropolitan Gas Company were noticed in our issue for Dec. 28 (p. 712). It is wholly a financial measure, and has for its object the setting of the Company's house in order to conform with the times, in respect of capital powers. In the first place, it is declared that the capital of the Company consists of £6,609,825 of stock, and the loan capital of £1,895,445 of 3 per cent. debenture stock. The repeal of all unexercised powers of issuing capital and debenture stock is sought; and this is followed by a desire for authorization to the raising of £1,000,000 by the creation and issue of ordinary stock or preference stock, or wholly or partially by one or more of these modes respectively. The power to borrow on mortgage is placed at one-third part of the additional capital. Following the clause to confer power to create and issue debenture stock, are provisions as to the mode of issuing stock, which were sufficiently described on Dec. 28. The Directors also require authority to issue as redeemable preference stock any portion of the capital which the Company are or may be authorized to raise as preference stock, and as redeemable debenture stock any money authorized to be raised as debenture stock. Authority is taken to provide funds for redemption purposes. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Uxbridge Gas Company are promoting a Bill for the transfer to them of the undertaking of the Eton Gas Company, to extend the limits of supply, and for other purposes. The issued capital of the promoting Company consists of £147,925 of consolidated stock, entitled to a dividend of 5 per cent. per annum, subject to increase or decrease under the sliding-scale. They have also borrowed £3000 on mortgage, have created and issued 4 per cent. debenture stock to the nominal amount of £33,875, and have received in respect of this debenture stock £32,401. The price now charged for gas is 3s. 8d. per 1000 cubic feet. The issued capital of the Eton Gas Company consists of £5250, divided into 350 "A" shares of £15 each, entitled to a maximum dividend of 10 per cent. per annum; £4750, divided into 316⅔ "B" shares of £15 each, entitled to a maximum dividend of 7 per cent. The Eton Company have also created and issued redeemable debenture stock to the amount of £1700, bearing interest at the rate of 4 per cent. per annum, but have not borrowed any sums on mortgage. The Eton Company are authorized to charge a maximum price of 7s. per 1000 cubic feet; and the price now charged by them is 4s. 3d. per 1000. The terms of transfer have been agreed to. The lands of which the Eton Company are in possession are reputed to be subject to certain Lammas or other commonable rights exercisable by inhabitants and tenants of the manor of Eton-cum-Stockdales and Colenorton, which rights might interfere with the utilization of the lands by the Uxbridge Company for the storage of gas, as authorized by this Act. The Company therefore suggest the expediency of being authorized to purchase and acquire all such existing rights in respect of the lands in question. The clauses provide for the extension of the limits of supply to include the urban district of Eton and certain specified parishes, within which added limits the Company ask to be allowed to charge 6d. per 1000 cubic feet in excess of the price of gas supplied within their limits as at present existing; but this excess charge is not to be taken into account in calculating the rate of dividend. Powers are sought to lay a connecting-main, and to use a piece of land at Eton Wick for gas storage purposes. As soon as is reasonably practicable after the date of transfer, the Company are to issue to the holders of ordinary and preference shares in the Eton Company preference stock in the Uxbridge Company as follows: To each holder of Eton "A" shares, £30 of preference stock for each share held by him, to each holder of "B" shares £21 of preference stock for each share —the stock to carry a dividend of 5 per cent. Authorization for the creation of the necessary amount of preference stock is sought. Provision is also made for the payment of a dividend on the Eton shares up to June 30 next. Each of the Directors of the Eton Company is to receive £210 by way of compensation for loss of office. Borrowing powers are desired up to one-third part of the issued capital; and section 17 [Limit of Interest on Money Borrowed] of the Uxbridge Order of 1914 is to be repealed. The Treasury capital-raising restriction clause has appended to it this provision: "Provided that nothing in this section shall be deemed to restrict the creation and issue of preference stock to proprietors of shares of the Eton Company in pursuance of the section of this Act of which the marginal note is 'Creation of Stock for Purposes of Transfer.'" Among miscellaneous provisions is one providing for differential prices, but protecting consumers against preferential ones under similar circumstances. [*Parliamentary Agents: Messrs. Lees and Co.*]

PROVISIONAL GAS ORDERS.

The Provisional Order which the Fleetwood Gas Company have lodged with the Board of Trade has a main purpose, and that is to alter sections 27 and 28 of the Company's Act of 1912, so that they shall be read and have effect as if the words "not exceeding the rate of four pounds per cent. per annum" were omitted therefrom; but, except with the consent of the Board of Trade, it is proposed that no higher rate of interest than five pounds ten shillings per cent. per annum shall be paid by the Company in respect of any money borrowed by them. Another clause relieves the Company from any obligation to give from any main a supply of gas for any purpose other than for lighting or domestic use in any case where the capacity of the main is insufficient for such purpose, or if, and so long as, any such supply would, in the opinion of the Company, interfere with the sufficiency of the gas required to be supplied by means of such main for lighting purposes. The only other clause worth notice is one which empowers the Company to levy and recover such charges as they think fit for taking the reading of any meter fixed in a house which is either in whole or in part let furnished, at the request, and for the convenience, of consumers, at times other than the Company's periodical readings. The charge for a special reading is not to exceed 6d. [*Parliamentary Agents: Messrs. Torr, Durnford, and Co.*]

The Long Eaton Gas Company have deposited an Order for a single purpose. It is to give them power to construct new works on lands scheduled—the land in question comprising 680 square yards, bounded north and east by other lands of the Company. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

ELECTRICITY SUPPLY MEMORANDA.

It is a matter of common observation that very minor happenings have often very large results in connection with electricity supply undertakings. Quite a small mishap at a generating-station may cause a considerable amount of damage by fire—as witness a long roll of occurrences—or may cut-off or disorganize supply for hours and perhaps days. A fusion in the distribution system may cause the generation from the insulation of quite a large quantity of highly explosive and poisonous gases, and do considerable damage to neighbouring premises by explosion, or to the inmates by suffocation. A pick driven into a cable in the district may do untold mischief. A pick hole in one of the distributing mains, the Electrical Engineer reports, was one of the major faults causing the recent large breakdown of the electricity supply at Finchley. The pick did its work with unerring thoroughness. We do not compliment it upon the results of its work, which were altogether out of proportion to the act. There was partial damage to the large generating set at the station. All the three main areas of supply were also affected; and there were numerous minor faults on consumers' premises. The Engineer is of opinion that street openings should be under supervision, as similar damage has been accomplished on several occasions; but as there has not been complete disorganization of the supply since 1903, it is clear the particular pick that made the disastrous hole on this occasion deserves exceptional censure.

That Naughty Pick.

Notice of Openings.

About the question of supervision, the "Electrician" does not seem to be particularly well informed on the law relating to the making of excavations by statutory undertakings. It says that the procedure often followed at the present day appears to be for anybody with the necessary powers to break-up the streets without consultation with those who have similar interests, with the result that an unfortunate stroke of a pick may cause a breakdown in the mains, as was the case at Finchley, and as was also the case lately in respect of water-mains at Brighton. Our contemporary also believes that in some undertakings it is the practice for notice to be given of excavations; and it looks upon this as a commonsense and businesslike method. The sections of the Gas-Works Clauses Act, 1847, regarding the opening of roads were incorporated in the Electric Lighting Act of 1882; and under section 8 of the 1847 Act, it is provided that three clear days' notice shall be given to the road-controlling authority before making openings. As a rule, in Special Acts the three days' notice is extended to a longer period. It so happens that the greater number of electric undertakings are owned by the local authority who are also the road authority; so that they have always information in advance of openings to be made by those with statutory right to occupy the subsoil of the roads. The Finchley Borough Council must have had notice of the particular road opening in which the pick made its onslaught on the electric cable; and it was quite open to them, if thought necessary, to have supervision over the breaking-up of the road on that occasion. The electrical papers do not inform us as to which undertaking was the transgressor in this matter; perhaps the culprit was a workman of the electrical undertaking itself. In its comment, the "Electrician" only speaks of electricity and water undertakings as occupants of the subsoil of roads, but probably in its remarks gas supply comes under a reference to "any of the public services." However, our point here is that electricity-owning local authorities are in a specially good position to know all about what other statutorily authorized road openers are doing—more so than are the latter of what the electricity undertaking are proposing.

Electrocuted.

The inquest has been held on the two good-natured fellows who at Eastbourne, on the day following Christmas Day, went to the rescue of the occupants of a motor car which had collided with an electric pillar switch-box, and who lost their lives in consequence. Their names are Ebenezer Shadwell, a coal merchant's carman, and Private Thomas Marshall, of the Royal Army Medical Corps. It was a novel occurrence; but the pity of it is that there is not any great likelihood of profit in the way of future protection coming out of the lamentable mishap, unless the Board of Trade insist on above ground pillar switch-boxes being placed out of the way of all possibility of accident through collisions in these days of fast-moving traffic. Mr. A. P. Trotter, the Electrical Adviser of the Board of Trade, was present at the inquest; but whether he secured any useful lessons from the sad event cannot be said. All that the Jury could find to append to their verdict was that such pillar switch-boxes should be placed further from the side of the footpaths. The Corporation Electrical Engineer explained that he preferred the above ground pillar switch-box because it was dangerous for the men to handle live wires in underground boxes. The chauffeur of the motor-car which did the damage could not account for the accident in any way. Just at the point, he said, the car seemed to swerve, and there was nothing whatever to account for it. There was suggestion that perhaps some magnetic influence came into play; but, of course, no one can give credence to any such idea. However, the box was broken, and three high-tension cables were exposed and torn away. The deaths of the two men are not, under such circumstances, difficult to account for.

An Electrified Kitchen at Euston.

The electrical papers are filled with pride. Perhaps the largest single electric cooking installation in the country is now to be found at Euston, in connection with the new dining-room opened there by the London and North-Western Railway Company. The equipment has been supplied by the Brompton and Kensington Accessories Company. We have not had an opportunity of making an inspection, and so can only explain the components of the installation from what has appeared in the electrical papers—taking as our guide and friend the "Electrical Review." Our readers will see that the installation is a very substantial one; and it is also one that is likely to be very costly in running, judging from the confessions of electrical engineers and other experimental users of electric cooking appliances, of which experiences the London and North-Western Railway Company have probably been kept utterly in the dark. However, they have commenced to accumulate experiences of their own; and we undertake to say that an electrical expert will be keeping a constant supervising eye and hand upon this plant for many a day to come. The installation is in a basement kitchen and servery and grill adjoining the dining-room. The kitchen equipment consists of four ovens, each measuring internally 2 ft. by 2 ft. by 2 ft. 6 in. high, with the heating elements around the sides and back. Seven different heats are provided. Above the ovens is a hot closet, with a maximum loading of 3 KW. The total loading of the oven range is 23 KW. Adjoining are two ham-boilers, each of 30 gallons capacity. Together these have a loading of 7·5 KW., and adjoining this apparatus is a double grill for kitchen use, both appliances being provided with heat regulation, and the latter with 7 KW. loading. Fuses and pilot lights are plentifully scattered about the installation. In the centre of the kitchen is a large boiling-table equipped with 23 hotplates of from 2000 to 1200 watts maximum loading, giving a total loading of 38·6 KW. Each plate is provided with a three-heat regulation switch. A bain-marie, arranged in two sections with 1500 watts, maximum loading, a hot closet for 1000 plates with two-heat regulation and a loading of 3·7 KW., and a vegetable steamer with six nests, and a 4·5-KW. loading with three-heat regulation, are also installed; while adjacent to the service lifts in the entrance, which communicate with the servery above, is a small hot closet, of 2·3-KW. loading, for keeping food warm while it is *en route* to the servery. In the servery, there is a vegetable server with a 4·2-KW. loading and two heats to each compartment. Two soup tureens, kept hot by means of water-baths, are also fitted; the heat regulation being under control by six push-and-pull switches. The servery also contains a large carving-table with five cutting dishes for joints and other sundries. An electrically heated shelf behind enables plates and food to be kept hot while waiting delivery; and hot cupboards are also provided below the table for keeping food warm. The total loading of this apparatus is 10 KW. The electric grill is clearly visible from the dining-room. It has two grilling compartments, with hot closets both above and below, and has a 12·5 KW. loading. The switches in this case are of the push-and-pull type. It has always been proclaimed that there are no fumes and no hot air to dispose of with electric cooking; but here fresh air is introduced and used air exhausted through special shafts. Each piece of apparatus is on a separate fused circuit and each circuit is led through a meter with a view to obtaining complete cost records.

Thin Criticism.

A peculiarly ineffective comment has been made by "Electrical Industries" upon the paper that Mr. W. A. Tookey recently read before the Institution of Junior Engineers on the "Modernization of Power Plant in Factories." [See "JOURNAL" for Dec. 28, pp. 699, 705.] Our contemporary is generally in unhappy case when it touches on the power question; for it is given to quibbling over terms and phrases. But it never by chance devotes itself to demonstrating, by figures and other data, that those are wrong who are deemed worthy of its weakly criticism in this connection. We see that Mr. Tookey "harped" on the "alleged" greater economy of the gas-engine as compared with the electric-motor. But we fail to see that his allegation has in any way been undermined by the writer in "Electrical Industries." Mr. Tookey is a man not only of figures and theoretical computations, but of large practical experience with power agents—an experience that it is evident cannot be claimed by his critic. As a sample of the absurdity of the criticism, it is pointed out that Mr. Tookey gave a table which shows that, according to the age of an engine, as indicated by the differences in compression, the gas consumption will vary from about 35 to 18 cubic feet per brake-horse-power-hour. Then we come to the gem of the criticism. It is remarked that these wide limits having been admitted, "Mr. Tookey then commenced to compare the cost of gas-engine and electric-motor operation by 'assuming' that the average engine demands only 19 cubic feet of gas per brake-horse-power-hour for its successful operation." The critic seems to think there is something wrong in the adoption of 19 cubic feet; seeing that the consumption may vary between 35 and 18 cubic feet. But why he thinks this, he does not explain. Let us remind him that Mr. Tookey was dealing with the "modernization" of power plant in factories; and in modernizing his power plant, an owner would take the modern engine with modern compression, and get the best possible efficiency. Mr. Tookey was really erring on the side of liberality in taking an average of 19 cubic feet of gas. But the critic—purblind critic!—apparently fails to understand why, in constructing a case, it is always safer to be generous against oneself than throw open oneself to criticism by extreme claim. However, because Mr. Tookey took 19 cubic feet per brake-horse-power-hour, the critic opines that the comparisons he makes are far too suggestive of special pleading to be taken seriously. There is genuine short-sightedness about the critic. Mr. Tookey made a special point of the higher initial cost of a gas-engine than of an electric-motor; and we think he might have made a note of capital cost in relation to work capacity, as illustrated by Mr. H. C. Widlake in connection with a laundry illustration, of which "Electrical Industries" really fights shy. [See "JOURNAL," June 22, p. 695, and this week.] Again, the critic complains that oil, water, and attendance, are not immediately referred to as exercising a "profoundly" qualifying influence on the comparisons given in regard to cost. The critic has to admit that Mr. Tookey was not negligent of any of these matters; but he seems to think that the manner of treatment did not give the sum-total of costs in a truly comparative way. Mr. Tookey's paper was prepared for men of intelligence, with engineering knowledge. However, the critic suggests that the advantages of the electric-motor are prompting smaller factory owners gleefully "to scrap their gas-engines in favour of the far more economical electric-motor." He does not show by definite method where the greater economy of the electric-motor comes in; Mr. Tookey did illustrate the greater economy of the modern gas-engine. Further the critic does not tell us how it is the makers of gas-engines have had to increase the size of their establishments, nor how it is that gas undertakings are doing remarkably well with their power loads—many of them better than ever before.

Living Wages and the Man.

At intervals, there is complaint as to the exiguous salaries paid to those who are in immediate charge of electricity generating stations. The trained technical assistants chafe under the injustice, as do the technical assistants in some other industries of which there is intimate knowledge. The matter is again raised in the "Electrical Review" by a writer, signing himself "Chief Assistant." Electricity stations, like gas undertakings, have suffered a drain upon their men; and some of the knowing assistants have left stations where the remuneration is poor to take positions where the emoluments are of a more attractive order—perhaps made so in some cases through the pinch that exists for properly qualified and capable men. According to the correspondent of the "Review," in many cases there has been an attempt to stem the tide of affairs by offering paltry war bonuses and an enamelled badge, as compensation for the extra cost of living, and possibly to imbue the men with the importance of their position to the community. Lately, however, there has been increasing difficulty in getting suitable men as charge engineers and switchboard attendants. The practice is, however, growing (and it is described as a "reprehensible" one) of promoting untrained switchboard attendants to positions of charge engineers, no doubt with a view to economizing on salaries, which are often on a level with the wages paid to an engine-driver or greaser. The results, it is stated, are very apt to be reflected in the shape of increased generating costs, particularly on the steam side of the plant. We are afraid that much the same thing can be said in regard to some—fortunately not all—gas undertakings under the control of local authorities. The penny-wise-and-pound-foolish policy of certain local administrations is notorious. They will offer an ordinary workman's wage to technically trained men, upon whose advice weighty financial issues very often depend; and, on the other hand, they will spend money lavishly in the provision of something that is more or less a luxury—such as in providing electrical equipment for a workhouse. The characteristics of local government are very singular. However, "Chief Assistant" complains that the Institution of Electrical Engineers has never evinced a genuine interest in electrical stations or their engineers. Not long since, the complaint was made that the Institution of Gas Engineers did nothing whatever to protect the status and conditions of members of the gas profession who are in municipal service. There is no consolation in this unanimity. It simply exemplifies that degeneracy, or inability to appreciate the necessities of the times, on the part of some of our local governing bodies, is a growing defect, and that the technical bodies of two great industries do not live up to their opportunities, or are incompetent to take the initiative in a matter of considerable and pressing importance to a not negligible part of their membership.

Mr. and Mrs. James Lee, of Eccleshill, near Bradford, celebrated their Golden Wedding anniversary recently. Mr. Lee was for about 36 years Manager of the Eccleshill Gas-Works, retiring in 1902, when he was presented with a handsome writing desk by his employers.

PERSONAL.

The appointment is announced of Mr. A. M'D. Duckham as Deputy Director-General of Munitions Supply. Mr. Duckham was for some time at the Munitions Invention Department.

Mr. A. P. Kelsey, one of the country representatives of Messrs. Falk, Stadelmann, and Co., Limited, who is well known among gas managers in the South-West of England, has joined the Royal Flying Corps.

Mr. G. H. Elliott, of the Exmouth Gas Company, has obtained the appointment of Superintendent at the Flathouse works of the Portsea Island Gaslight Company. Previous to going to Exmouth, Mr. Elliott was with the Nuneaton Gas Company, and also at the Hull station of the British Gaslight Company, under Mr. John Young.

Professor W. H. Perkin, F.R.S., Professor of Chemistry at the University of Oxford, has accepted the post of head of the Research Department of British Dyes, Limited. He has also accepted the chairmanship of the Advisory Council of the Company, in place of the late Professor Raphael Meldola, F.R.S. Professor Perkin is the eldest son of the late Sir William Perkin, the founder of the coal-tar colour industry. From 1887 to 1892 he was Professor of Chemistry at the Heriot-Watt College, Edinburgh; and he held a similar post at Victoria University, Manchester, from 1892 to 1912.

We are gratified to see, among those to whom the Military Cross has been awarded for service in the field, the name of Second-Lieutenant Clive Griffin, R.A. (T.F.), only son of Mr. William Griffin, the Secretary and General Manager of the Folkestone Gas and Coke Company. He is one of five cousins, all living in Folkestone, who are serving in the army. Lieutenant Geoffrey V. Stringer, North Midland Brigade, who has also been awarded the Military Cross, is a son of Mr. E. H. Stringer, of Oakfield, Wolverhampton; the family being closely associated with the iron trade in the Midlands. Lieutenant Stringer volunteered for foreign service on the outbreak of war, and went to France in March. He was identified with the engagements at Neuve Chapelle and Ypres.

OBITUARY.

The death of Mr. John Fyfe, the Managing Director of Young's Paraffin Light and Mineral Oil Company, Limited, recently occurred at Kelvinside, Glasgow, at the age of 80.

Among the killed, in the casualty list of the Expeditionary Force dated the 2nd inst., appeared the name of Lieutenant N. Ayris, of the Royal Engineers, grandson of Mr. John Ayris, M.Inst.C.E., formerly the Engineer to the Great Yarmouth Water-Works Company.

The death occurred, last Tuesday, at his residence at Springfield House, Cliffe Lane, Baildon, Yorkshire, of Mr. John Robson. Deceased, who was 73 years of age, was a native of Colne, and was the founder of the firm of J. Robson (Shipley), Limited, gas-engine makers. He retired six years ago.

Mr. William J. Dowse, whose death took place last week, was Manager of the Bradford Corporation gas-works at Valley Road, Manningham. Mr. Dowse was highly respected by all sections of his staff, and by a wide circle of business and private friends. At the funeral there was a large gathering, which included Mr. Charles Wood, the Bradford Corporation Gas Engineer.

Mr. T. M. Barron, who recently died at Darlington at the age of 63, was for a great number of years a well-known figure in the public life of the town. For several years he was Chairman of the Gas Committee, which under his presidency brought the works to a successful state second to none in the North. Besides a thorough knowledge of the lighting requirements of the town, Mr. Barron was possessed of a remarkable technical knowledge of gas manufacture; and he imparted into his duties something more than a layman's oversight. He was always highly respected by all the officials.

Yorkshire Junior Gas Association.—A meeting of the Association will be held next Saturday afternoon, in the lecture-room of the Bradford Gas Department show-rooms, Darley Street, when Mr. J. Demain, of Garforth, will deliver his Presidential Address, to be followed by a discussion.

Production of Artificial Fertilizers in Germany.—According to the "Engineer" newspaper, Herr Alfred Lohmann, the Chairman of the Chamber of Commerce of Bremen, stated at a meeting on the 28th ult. that the numerous new electric nitrate works in Germany had succeeded in producing not only all the saltpetre required for the manufacture of explosives, but would be able to supply during the coming spring all the artificial fertilizers required for agricultural purposes. As Germany previously imported over half the total Chilean production of natural nitrates, this is a remarkable achievement for the German electrical industry if it is actually the truth. Herr Lohmann even suggested that Germany would shortly be able to export artificial nitrates; but in view of the comparatively high cost of electric power in Germany, the price would exclude any competition with Chilean nitrate or even with the Norwegian products.

GAS AND FUEL LEGISLATION IN FRANCE.

Perusal of the pages of our contemporary, the "Journal des Usines à Gaz," shows that the natural and inevitable difficulties of the present time, which our French *confrères* have invariably met in a spirit of patriotic resourcefulness, are likely to receive nothing in the shape of amelioration, but rather the reverse, from a mass of proposed legislation of one kind or another, but generally of the arbitrary bureaucratic genus which fails to grasp the realities calling to be dealt with. Drastic artificial measures can never succeed in remedying, even temporarily, a state of things which springs from deep-seated natural causes, and may often intensify the disturbance which they seek to remove. Hence the feelings, not too strongly described as dismay, with which the French gas and coke industry has witnessed the measures suggested for the adjustment of conditions which, from the nature of the exceptional national circumstances, call for infinitely greater statesmanship than in times of peace.

After a discussion extending over several sittings, the Chamber of Deputies early in December last passed a Bill for the fixing of the prices of commodities, including those for heating and lighting. According to this, prices in a given town may be fixed by the mayor or, if circumstances so direct, by the prefect [of police], with the assistance of an advisory committee drawn from the chambers of commerce and agricultural syndicates. Infringements of the ruling of one or the other of these newly-empowered authorities are punishable by fines or imprisonment, while the goods which are the subject of the infringement may be requisitioned by the authorities. In supplement to this sufficiently drastic measure, an amendment was adopted authorizing the compulsory production on the part of a merchant, of a declaration of his supplies, under penalties similar to those for infringement of the authorized prices.

The declared object of the Bill is to eliminate the rise in prices of (mainly) articles of food as the result of unscrupulous speculation. The question of the price of gas hardly figures at all in the verbatim report of the protracted, and often irrelevant, discussion in the Chamber which the "Journal des Usines à Gaz" prints as a supplement to its issue of Dec. 20. Indeed, in answer to the direct question whether the prefects would have the power to fix the price of gas or electric current below that of existing contracts, it was stated that this could not be done, for the obvious reason that a price fixed by contract was not subject to elevation at the hands of the speculator. Our contemporary, at the instance of the Société Technique, the Syndicat Professionnel, and the Comité Central des Cokes, has presumably gone to the expense of laying the full discussion of the Bill before its readers, mainly with the object of demonstrating the general lack of perception of the Chamber in its dealings with economic questions. It appends two leading articles from "Le Temps" severely criticizing, not the aims of the Bill, which admittedly are laudable, but the ineffectiveness and futility of its measures. They comment on the absence from the debate of any discussion of the cause which disturbs the balance of supply and demand, or of any recognition of the fact that the fixing of a retail price can only increase demand still further, and so tend to paralyze the enterprise of producers thus hardly hit. The appeal is made to the Government to recognize the national spirit of merchants and producers instead of treating them as suspects; also to examine more thoroughly, and with the object of relieving the national situation, the question of transport by rail and sea, and the better organization of the existing transport facilities.

While the foregoing Bill has been passed by the Chamber and merely awaits ratification or modification by the Senate, a further measure, of much more vital importance to the French gas industry, has been drafted by the Commission of Mines of the Chamber of Deputies. It embodies two previously drafted Bills, and seeks to regularize the distribution, sale, and price of fuel by the establishment of a central bureau for the control of all fuel for public and industrial use. According to this suggested measure, a central or national office shall have the power to requisition the whole supply of fuel by the creation of sub-bureaux in mining districts and at all ports. These sale bureaux will receive the requisitions from the central office, and carry out instructions as to the supply of other requirements. Railway companies and gas undertakings are to apply to the central office stating their needs. Any sale by home producers or importers, otherwise than through a sale-bureau, is declared invalid. The regulations apply also to metallurgical coke. Producers of gas coke are to observe the directions as regards priority of sale, which they are to receive from the central office. The Bill likewise seeks to extend its scope to the fixation of prices of coal of various grades from French mines as well as of coal imported from abroad. In the case of French or imported coal for domestic consumption, prices are to be fixed locally by the prefects in accordance with those at the mines or at ports of disembarkation, supplemented by sums equivalent to the cost of transport and to those of any local duties, and with regard to established customs of supply and delivery and to a normal commercial return. In the case of coal for purposes other than domestic, prices to be paid at the pit or port are to be fixed by an order of the Ministry of Public Works issued on the first and fifteenth of each month—such prices being calculated from the average figures for French and imported coal, but with additions to relieve the central office from the expenses incurred in maintaining advantageous prices in certain departments or communes, while also open to reduction in respect to advantages secured by the office from its arrangements for metallurgical coke. The latter is to be acquired by the National Office at a price fixed by the rules applying to other requisitions. Its sale price will be fixed by the office so as to approximate to that of requisitioned French coke and imported cokes. Prices of gas coke will be fixed by fortnightly orders of the Ministry of Public Works as in the case of coal. Balances representing the differences between sale prices for domestic fuel and those granted to producers and importers will be paid to the latter in the month following delivery. An exception to these regulations applies to coal necessary for the requirements of the mining undertaking itself, or for consumption by mine employees or the public in mining districts. In these cases the sale price may not exceed that permitted to the producer. Infringements of the regulations are to be punishable by imprisonment from six days to six months, or by a fine of 500 frs. to 10,000 frs., or by both.

Against this piece of complex and artificial legislation, the Central Committee of French Collieries has made emphatic protest to the Ministry of Public Works. In affirming its desire to give its support to any measure in the public interest, it declares its firm conviction of the serious inconveniences which would follow from the proposals outlined above. While it regards as useful the establishment of a central bureau for the control of supplies as regards quantity and priority, on the other hand it views the assumption of powers for the movement and financial control of the whole supply of fuel, home or imported, as leading to disorder, grave financial risks, paralysis of existing facilities, and discouragement of those already actively engaged in the industry. While the Committee considers that the circumstances call for Government supervision of prices charged by the producers and importers—it had submitted its own suggestion six months previously, and believes that importers have decided to act along the same lines—yet it cannot help regarding a scheme of fixation of prices as dangerous, since under such a system it is impossible to provide against highly fluctuating factors such as freight and demurrage. While effective encouragement of municipal enterprise in ensuring local supplies of coal is undoubtedly to be welcomed, the compulsory assumption by 30,000 French municipalities of the monopoly in the acquisition, holding, and sale of domestic fuel impresses the Committee as a provision lacking in prudence.

The domestic consumption should be the subject of special supervision, in the form of an increased allowance from the suppliers of French coal at a low price in the shape of a reduction of the tariff on imported coal with its attendant pressure on less well-to-do households. Moreover, the Committee views with great disfavour the distinction drawn between the mining departments and those not of this character.

Finally, the Committee strongly protests that the coal problem is one only of transport. The only measures which will be really effective are those for the better utilization of rolling stock, unloading facilities at ports, and adjustment of freightage charges. While acknowledging the desire of the Government and the apparent logic of the proposals, the Committee urges that the measures which the situation demands are of a much less ambitious and more practical kind. It calls for energetic and persistent action by the Government.

That transport—or rather lack of it—lies at the root of the fuel question in France at the present time is further shown by a recent memorandum to its members by the French Professional Syndicate of the gas industry. The problem of supplies becomes daily more acute from this cause. Barges obtainable with the greatest difficulty even at alarming rates, ships delayed for days at ports before being able to discharge cargo, excessive demurrage and storage charges (the latter the result of shortage of waggons)—such is the situation which the Syndicate depicts in a strain of positive anxiety. A conference on the subject has been held with the Minister of Public Works, when the dangers of the situation were represented; and it is hoped that such measures as are possible in the present conditions will be promptly taken.

COAL MINING AND THE WAR.

Second Report of the Departmental Committee.

It may be remembered that, some considerable time ago, a Departmental Committee of seven members, with Sir Richard A. S. Redmayne, K.C.B. (Chief Inspector of Mines), as Chairman, was appointed to inquire into the conditions prevailing in the coal-mining industry, with a view to "promoting such organization of work and such co-operation between employers and workmen as, having regard to the large number of miners who are enlisting for naval and military service, will secure the necessary production of coal during the war." After hearing evidence and securing information as to the shortage of labour and consequent decrease in output, the Committee issued a report containing various suggestions, the nature of which will be found indicated in the "JOURNAL" for June 15 last (p. 633). They have now supplemented it by a second report; being, of course, by this time in a position to show the effect of the war on the coal mining industry during the first twelve months of its continuance, and the results achieved by the remedial measures proposed in the earlier report.

In the event, it appears that the loss of output has not been so great as was anticipated might be the case, mainly owing, it is thought, to the effect of the measures taken to mitigate the falling-off due to depletion of labour. Without any counteracting steps, it was calculated that the loss in production would probably amount to 36 million tons, against which might have to be put a reduction in exports of 24 million tons. Actually, the loss of output (omitting consideration of a small number of pits from which no returns were received) in the first twelve months of war, as compared with the like pre-war period, was somewhat under 30 million tons, or about 11 per cent. The falling-off was spread unequally over the period; the average monthly rate of decrease being over 3 million tons for the first seven months, as against something less than 1¾ million tons in the succeeding five months. When looking at the figures, it must, however, be borne in mind that the reduction in output during the earlier part of the war period was chiefly due to lessened demand; whereas subsequently it was owing almost entirely to the shortage of labour. Taking another period, the first three months of the second year of war, and comparing it with the first three months of the war, it is seen that the output of August, September, and October, 1915, exceeded that of the same period of 1914 by over 1½ million tons, though there was a falling-off when compared with the like three months in 1913 of 7¼ million tons.

In the opinion of the Committee, it is remarkable that the falling-off in output of late has not been greater, in view of the steady depletion of mining labour which has taken place. It is calculated that the number of enlistments over the first thirteen months of the war amounted to more than 250,000, or 22½ per cent.; and as the net loss of employees in the pits making returns was 160,510 persons, or practically 16 per cent., while the enlistments totalled 235,000, it is obvious that there had been a substantial influx of labour to the mines. The average number of persons on the books during the first year of the war was 11½ per cent. less than in the year before the war; the average number of persons employed below ground falling-off by 12·6 per cent.

The Committee are pleased to find themselves in a position to state that the absenteeism did not increase, but remained the same during the last few months as in the earlier period of the war—namely, 9·8 per cent., which compares with 10·5 per cent. for the like period of the pre-war months. It is their belief that the efforts of the miners' leaders in attempting to secure more regular attendance at work have not been without result; but in this connection the important facts to be borne in mind are that, taking the coal-getters and coal-putters only, the absenteeism is very much higher than the average just stated, and that, if there were no avoidable absenteeism, the output would be increased by from 13 to 14 million tons per annum. Absenteeism is lowest in Scotland, and highest in England. It is from the North Staffordshire and Yorkshire districts that complaints in this respect have chiefly been received. It is perhaps an understandable fact that the districts having the thinnest seams of coal, and where the coal is hardest to get, should show generally speaking the best results in the matter of regular attendance at work. In the first report, the Committee pointed out that it was specially desirable during the war that the employers should co-operate with the representatives of the workmen on questions likely to tead to friction or stoppage in the present unprecedented circumstances. Through the medium of the Mining Association and the Miners' Federation, owners and workmen in districts where hitherto little had been done in this direction were urged to reduce absenteeism and put a stop to friction. One suggestion was the keeping of careful returns as to absenteeism in respect of those days on which coal was being wound at the mine. In some instances, joint committees of the management and the men have been established to watch the rates of absenteeism, and to endeavour to bring about more regular attendance at work. Information which the Committee have received satisfies them that a good deal has been done in concentrating the work of getting coal in the easier places in the mines, and in postponing developments and renewals which would in the ordinary course have been proceeded with.

On the subject of transport, the Committee realize the great difficulties with which the railway management have had to contend; and they understand that these difficulties will be increased in the near future [the report is dated Dec. 10], by reason of military exigencies. Transport facilities are being very materially affected by lack of available locomotive power; and their information is that this state of affairs will become worse, as movements of troops and munitions increase. They have therefore considered how far relief could be obtained in the direction of reducing the amount of work requiring to be done by the available locomotive power; and they have been advised that considerable advantage would be secured by some system of pooling of traders' and railway waggons in different districts. It is recognized, however, "that the value of any such proposal would depend upon the simplicity and efficiency of the system of pooling that might be adopted, and also that it would be most desirable that the proposed system should, if possible, be adopted with the concurrence of the coalowners and other interested parties in different parts of the country." In these circumstances, they recommend the preparation of a scheme of pooling suitable for the different districts, and its consideration by those concerned; and they think that "the Government might consider, upon the situation thus disclosed, as to the advisability of legislation upon the question"—any such scheme to operate only during the period of the war. As to the shipping position, the Committee feel that they are not in a position to judge how far matters could be improved by the exercise of control; but "they are informed that, without prejudice either to international considerations or to the other carrying trade of the country, ships might be compelled to trade between home and foreign ports in the interests of the coal industry." If there is any possibility of improvement in this direction, the Committee remark that the matter might very profitably be made the subject of expert inquiry; and they recommend that such an inquiry should take place.

The total output of coal from the pits (quarries are not here included) during the first year of war is put at 250,357,000 tons, which compares with 281,076,000 tons in the preceding twelve months. But as exports fell off by 29½ million tons, and the amount placed in foreign bunkers by over 6 million tons, there was left a balance for home use and the Admiralty of 188,965,000 tons, as compared with 183,849,000 tons. The Committee have reason to believe that the demand for coal is now no less than it was during the pre-war period; for though collieries have been held-up for want of transport facilities, they have heard of no instance of a colliery standing idle for lack of orders.

In conclusion, the Committee intimate that they propose to conduct further inquiry into the question of the regulation of the supply and price of pit timber, and that they will later on report upon this matter.

METHODS OF ECONOMY.

It would be difficult to find a more fitting subject just now for purposes of practical demonstration than the prevention of waste; and this being so, one may fairly anticipate a successful run for an exhibition representing domestic economy which is being held during the present week under the auspices of the Institute of Hygiene, in connection with the anti-waste campaign. There are lectures and demonstrations on economical cooking and labour-saving methods; and other matters drawn attention to are well calculated to advance the cause of domestic saving. The housewife who visits the Society's premises at Nos. 33 and 34, Devonshire Street, W., while the exhibition remains open may therefore depend upon getting some useful "wrinkles."

It is impossible to state in detail here the nature of all these "wrinkles;" but it may be said that Miss Helen Edden and her staff are demonstrating the uses of the gas-cooker in a delightful "all-gas" kitchen which has been fitted up by the Gas Light and Coke Company. Perfect cleanliness is not only suggested, but achieved, by the green and white tiles which form a dado round the walls. These tiles are curved outwards at the bottom, so that there is no opportunity for the collection of dirt at the point where the floor and th walls meet. For the floor, too, wood blocks are used, which are easily cleaned and polished. Three different methods of water-heating have been installed, so that visitors, whatever their requirements may be, will be sure to see something in this direction to suit them; and something, of course, they must have, if they follow the lines of this model kitchen, and do away altogether with the coal-range. In a recess, tiled all over, is a Parkinson cooker, and at its side a "London" coke-boiler, suitable for a house where a lot of hot water is required. Then for a medium-sized house or flat there is a Potterton combined apparatus, with storage tank and boiler all in one. The third system is a Parkinson "Gacylette," for use where people do not wish to go to the expense of providing flow and return pipes, or where the existing circulating system is unsatisfactory. This apparatus consists of 3 gallons storage capacity, and of means for heating the water. If fitted over the sink, it will conveniently furnish the hot water required for washing up; and the bathroom can be served by a geyser.

Though not yet in position, it is intended eventually—the model kitchen is, of course, to be a permanent addition to the usefulness of the building—to fix over the cooker in the recess a plate hot-cupboard with a glass front and sliding doors, similar to one which has recently been installed in the New King's College for Women. Open bars are provided at the bottom, through which heat passes upwards, from the top of the cooker and the gas or coke boiler (as the case may be) at its side, into the closed-fronted cupboard, which thus becomes an efficient plate warmer. Frequently, in the case of kitchens from which the coal-range has been entirely removed, mistresses complain that there are no means by which the maidservants can warm the kitchen, when they desire to do so; and as a suggestion for meeting this point, there has been placed in the model kitchen a small Richmond "Surrey" condenser, which looks bright and does not consume much gas. Lighting is by a Sugg ventilating lamp; and there is, above the cooker recess, a flue outlet from the room.

Those on the look-out for novelties will have their attention taken by the "Utility" hot-plate. It is found that in the ordinary way there are many consumers who have only a gas-ring; and the object of the invention is to increase the usefulness of these handy appliances by rendering them available for various sorts of cooking. The "Utility" plate is on legs, and has a loose top where it comes over the burner; and the appliance makes a solid stand on which can be safely placed (say) a large frying pan or a fairly heavy saucepan. For boiling the contents of a vessel, the loose top in the centre of the plate is removed; and when the boiling stage is reached the vessel is pushed to one side (where there is sufficient heat to keep it boiling), and another utensil takes its place. So one can have three or four vessels boiling, with the consumption of one gas-ring. The plate is designed so that, while heat radiates to the screened corners, there is no interference with the passage of air needed for combustion. The "Utility" hot-plate (which it is understood is being brought out by one of the large gas companies) has every appearance of being a thoroughly practical addition to the appurtenances of the small kitchen. It is strongly designed on a well-thought-out principle, and is to be made in three sizes, from 14 in. by 12 in. to 18 in. by 12 in.

Other working apparatus now in the kitchen includes a Rodda's "Dreadnought" plate-washer, supplied with hot water from the gas-boiler, and fitted with gas-burners underneath for keeping the water heated when it is in the machine; a Keith's low-pressure iron; and a "Uno" coffee-roaster.

For the demonstrations by the Gas Light and Coke Company's staff a Wright gas-cooker is being used, and upstairs, for other purposes, there are installed Richmond "Bungalow," Fletcher "Carick," and Davis cookers, and a "Chef" muffin plate.

DIGEST OF PATENT CASES.

A useful section of the reports of patent, design, trade mark, and other cases (which are published from time to time as supplements to the "Official Journal" of the Patent Office) is the digest prepared at the end of the year of the cases that have been decided. Looking through the digest of patent cases reported in 1915, which has been compiled by Mr. Frank G. Underhay, M.A., Barrister-at-Law, it is seen that on the present occasion there are naturally cases to be noted for which the war is directly responsible—the status of an "alien enemy" having had to be determined in various aspects.

There was one case in which, after a patent had been ordered to be revoked, war broke out, and the owners of the patent (who were a German company carrying on business in Germany) appealed; and it was decided that they were entitled to have the appeal heard in the ordinary course, in spite of the fact that they were alien enemies. An action of a somewhat different kind was that in which two companies joined in an action for infringement of a patent, but it was held that the patent had not been infringed. Here it was the plaintiffs who appealed; and, owing to the outbreak of war, one of the appellants became an alien enemy. In these circumstances, the appeal was suspended till after the conclusion of the war.

Ambiguity in the wording of specifications is a pitfall carefully, to be avoided by the patentee, for there is the warning of Earl Loreburn that, "if he uses language which, when fairly read, is avoidably obscure or ambiguous, the patent is invalid, whether the defect be due to design, to carelessness, or to want of skill;" and that "the only safe way is for the patentee to do his best to be clear and intelligible." An application for a patent for the use of a known substance in a new way, resulted in its being held that "the use of an old and well-known substance by itself, without anything more, does not constitute an invention." In one instance, too, a specification was held to be misleading because it did not achieve the result claimed; and the combination of old contrivances, each performing its old function, and not creating a new contrivance or producing a new or better result, was held not to have subject-matter.

These are only a few of the decisions recorded which are of importance to inventors. Design and trade mark cases are also included in the digest.

"Stella" Gas-Fires.

For the new patent "Stella" gas-fires, a particular value for use in the sick room or study is urged by the makers—the Carron Company. This is that the fires are absolutely silent in operation; while another feature claimed for them, which is of equal importance whatever may be the situation in which they may be working, is that they possess exceptionally high efficiency. The radiants themselves are specially constructed and fitted, and the fire is formed with the object of ensuring that no products of combustion can possibly escape except by the flue. Designed on simple and graceful lines, and with all parts standardized, and therefore interchangeable, the patterns of the "Stella" fire which are shown in the firm's recently issued booklet will appeal to gas consumers; and no doubt the Carron Company will be equally successful with the other designs which are now in course of preparation. The finishes have been arranged to meet the demand of every taste and scheme of room decoration. That is to say, the fires can be had in armour bright, "Cymric" (a new Carron finish which resembles armour bright, but is rust proof), or in bronze or enamel. Added to the points named, the assurance is forthcoming that rigorous tests have failed to make the burners light-back; while the regulation is of the simplest character, inasmuch as, once set for "full" by the patent controller, any alteration necessary to change the power of the fire is made by the tap.

Among wills lately proved is that of Professor Vivian B. Lewes who left estate of the gross value of £13,353.

At last week's meeting of the Institution of Civil Engineers the election was reported, as associate members, of Mr. John L. Butler, of the Leighton Reservoir Works, Masham, Yorks, and of Mr. Adam Morgan, B.Sc., of the Belfast Water Department.

THE "T. R. SPRAYOIL" APPARATUS

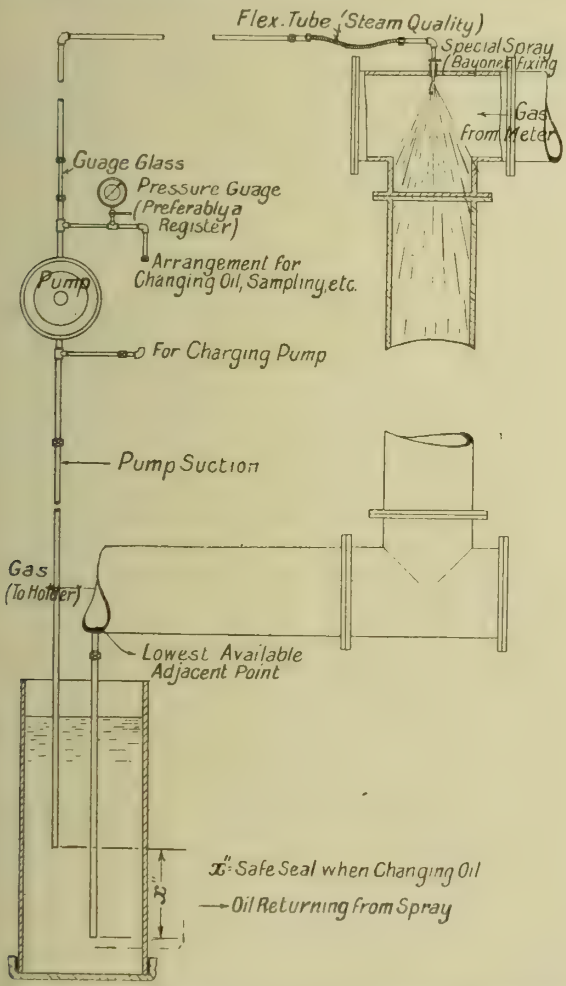
FOR THE PREVENTION OF NAPHTHALENE TROUBLES ON THE DISTRICT.

By William Thomson and R. H. Ruthven, of Ramsgate.

Much has been written on the subject of naphthalene troubles during the past few weeks; but we trust that a short description of how the question has been dealt with at Ramsgate may prove of assistance to anyone who is still experiencing difficulty.

For very many years naphthalene has given an immense amount of trouble in Ramsgate, and innumerable systems and experiments have been tried, with more or less temporary success, in order to overcome it. Some years ago, however, the writers came to the conclusion that, in preference to attempting to send out naphthalene-free gas, the best means of securing relief would be to provide the gas with sufficient solvent to either carry any naphthalene present to the point of combustion, or (in the event of condensation taking place in the mains) to ensure that the naphthalene came down in solution, when it would gravitate to the syphons and be disposed of in the usual way.

The means adopted to carry our conclusions into effect consist of a simple apparatus capable of atomizing a light hydrocarbon oil and bringing the gas into intimate contact with it. The lighter fractions of the oil thus atomized are carried forward mechanically with the gas, and are able to support any naphthalene present to the point of combustion, or, in the event of condensation, to retain the naphthalene in solution.


Flex. Tube (Steam Quality)
Special Spray (Bayonet Fixing)
Gas From Meter
Guage Glass
Pressure Guage (Preferably a Register)
Arrangement for Changing Oil, Sampling, etc.
Pump
For Charging Pump
Pump Suction
Gas (To Holder)
Lowest Available Adjacent Point
x = Safe Seal when Changing Oil
Oil Returning From Spray
x

The "T.R." Sprayoil Apparatus for the Prevention of Naphthalene Troubles on the District.

[All Measurements Depend Entirely on Local Circumstances.]

The accompanying sketch shows the plant as installed at Ramsgate on the station meter outlet. The receiver below ground is filled with oil, and the pump started—thus forcing the oil under pressure through the special spray, as shown. The gas from the meter travels with the oil mist, and carries along with it a certain portion of the light oils. The remainder of the oil returns to the receiver, and again goes through the spray; and in this way a predetermined quantity of oil is circulated for twenty-four hours, when the residue is pumped out and replaced with fresh oil. By this time the residual oil will have absorbed naphthalene to the extent of about 4 per cent. of its volume; but, as it is capable of absorbing considerably more, the residual oil is allowed to circulate through a rotary washer-scrubber until, if desired, it is practically saturated with naphthalene. The residual oil could, of course, be used in the same way in any available washing plant or portion of a rotary washer-scrubber.

Dealing with the naphthalene already in the mains and services on the district, if a small quantity of the unsaturated residual oil is blown by a force pump through the service, and also introduced at the highest points into the mains, it will slowly gravitate to the syphons, from which it can be cleared. Owing to capillary action, the oil during its journey through the mains creeps up the sides until the whole inside surface of the mains is coated with oil. In this way deposits of naphthalene in the mains and services are effectually cleared out, and the oil coating continues to act as a preventative of further naphthalene deposits, and thus assists the work of the oil-spray apparatus, while at the same time providing a protection against corrosion in the mains.

The system above described has now been in continuous use at Ramsgate for two-and-a-half years. While we cannot claim complete immunity from naphthalene troubles, yet with a reduction of from 300 or 350 to less than 20 in the weekly number of complaints, we think we have got the trouble well in hand.

The "C" process for toluol extraction has now been in operation for several months, with fortunately none of the attendant naphthalene troubles which have been experienced in the majority of works.

The necessary plant is inexpensive, easily installed, and extremely simple to operate—in fact, in a short time it becomes merely a question of routine, attended when necessary by unskilled labour.

GAS CONSUMPTION IN GERMANY.

JULY TO SEPTEMBER, 1915.

Statistics of the decrease or increase in gas consumption in Germany for each month since the outbreak of war, compared with the corresponding month of the previous year, were given in the "Journal" up to June last—[see "Journal" for Sept. 28, p. 695]. Figures collected from 925 German gas-works show that in the month of July the gas production exhibited an increase of 3·2 per cent. over that for July, 1914; figures for 848 works show that in August last the gas production increased by 13 per cent., as compared with August, 1914, and by 8·47 per cent. as compared with August, 1913—the last August before the outbreak of war. Figures collected from 879 works show that in September last the gas production increased by 16·7 per cent., as compared with September, 1914, and by 5·49 per cent., compared with September, 1913. These figures indicate that the strenuous efforts which were made last year in Germany to substitute gas as a fuel in place of oil and coal, met with a very considerable measure of success.

According to the Central Gas Publicity Bureau at Berlin, a study of the detailed returns discloses some interesting facts as to the districts in which the increase has been greatest. For instance, at Königsberg, in East Prussia, the gas consumption in August last showed an increase of 110 per cent. over that for August, 1913; and for September last, an increase of 76 per cent., over that for September, 1913. These enormous increases—equivalent in August to more than a doubling of the gas consumption—are ascribed to the extensive use of gas for industrial purposes, which has been encouraged by exceptionally favourable rates of charge. But in East Prussia generally large increases are shown. In Memel, notwithstanding the Russian occupation, the increase in September, as compared with the same month of 1913, was 18·2 per cent.; in Allenstein, it was 43·8 per cent., in Braunsberg 37·2 per cent., and in Insterburg 42·4 per cent. Numerous places in West Prussia show an almost equally large increase in gas consumption. In the rest of Germany the increases are chiefly where industry or other conditions have been greatly favoured by war influences. Decreases on a considerable scale have occurred only in those places of which the industrial life has been seriously injured by the war. The decrease has been largely due to reduction in street lighting and in the lighting of places of public resort and restaurants. This reduction has been to a great extent balanced by the use of gas by very large numbers of new consumers.

A Course of Lectures by Dr. Bone.—Readers are reminded that Dr. William A. Bone, F.R.S., Professor of Chemical Technology at the Imperial College of Science and Technology, is giving a course of three lectures, on the "Utilization of Energy from Coal," at the Royal Institution, Albemarle Street, W., at 3 p.m. on Thursdays, Jan. 20 and 27, and Feb. 3.

Coal Shortage in Austria.—A Press Association telegram from Zurich states that many of the larger towns in Austria and Hungary are suffering greatly from shortage of coal, which seriously interferes with the gas and electric lighting. In Buda Pesth, the electric lighting of the streets has been suspended, and private consumers have been warned that their supply of electricity may be cut off at any moment. In Vienna, cooking by gas has been forbidden. At Brunn (the capital of Moravia), private persons are only permitted to burn 70 per cent. of their normal consumption at the ordinary rate of payment, and are charged double for all gas used beyond this limit. At Debreczin, the gas lighting of the streets has been stopped, and the gas supply of the largest consumers cut off entirely. At Stuhlweissenburg, gas may be burned for illuminating purposes only, between 3 in the afternoon and 11 o'clock in the evening; but its use for heating and cooking is prohibited.

GASEOUS COMBUSTION AT HIGH PRESSURE.

Abstract of a Royal Society Memoir.

On July 31 last, the Royal Society published in its "Philosophical Transactions" a memoir bearing the above title, containing a detailed account of an experimental research carried out by Professor William A. Bone and collaborators (with the aid of grants placed at his disposal by the Government Grant Committee of the Society) in the Coal Gas and Fuel Department of Leeds University during the years 1906 to 1912, to which reference was made in Professor Bone's recent British Association address.

As the results of this research have considerably extended our knowledge of the mechanism of gaseous combustion, and form a concluding chapter of the long series of investigations upon hydrocarbon combustion associated with Professor Bone's name during the past fifteen years, it will probably interest our readers—most of whom will not have an opportunity of studying the original memoir—if we attempt to review at some length its principal features. This, it may be said at once, is no easy task, for the research has been a very long and laborious one, characterized throughout by a wonderful thoroughness, patience, and experimental skill, and manifold theoretical issues arising during its course are critically handled and set forth in the original memoir with a clearness and ability which can hardly be approached in a review of this kind.

In order that the reader may understand the objects and scope of the work, it will be necessary to preface our review of it by a brief statement concerning the results of previous investigations by Professor Bone and other investigators in this department of scientific activity. As long ago as 1892 it was discovered, in Professor Harold B. Dixon's laboratory in Manchester, that an equimolecular mixture of ethylene and oxygen yields on detonation almost exactly twice its own volume of carbon monoxide and oxygen, in accordance with the empirical equation:

$$C_2H_4 + O_2 = 2CO + 2H_2,$$

And about the same time, Smithells and Ingle, in their researches upon the structure and chemistry of flame, discovered the occurrence of a larger volume of hydrogen and carbon monoxide in the interconal gases of the aërated hydrocarbon flames.

This led to the revival of an idea put forward as long ago as 1861 by Kersten—namely, that "before any part of the hydrogen is burnt, all the carbon is burnt to carbonic oxide, and that the excess of oxygen (if any) divides itself between the carbonic oxide and the hydrogen. The idea of a "selective" combustion, whether of carbon or of hydrogen, is, however, so repugnant to well-established principles that it could hardly be expected to meet with general acceptance in any final or complete sense, and there were many sceptics as to its validity. Moreover, while in the cases of acetylene and ethylene the assumption of a direct transition from the system

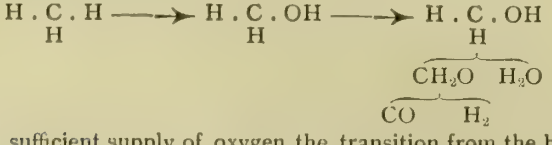
$$C_nH_m + \frac{n}{2} O_2 \text{ to } nCO + \frac{m}{2} H_2.$$

implies a simple transaction from the kinetic standpoint, an extension of the idea to the cases of such hydrocarbons as propane or propylene would obviously raise serious difficulties,

$$2C_3H_8 + 3O_2 = 6CO + 8H_2.$$
$$2C_3H_6 + 3O_2 = 6CO + 6H_2.$$

It therefore seemed necessary to consider whether the solution of the problem might not lie in the assumption of an initial association of the hydrocarbon and oxygen forming an unstable "oxygenated" or "hydroxylated" molecule.

This, broadly speaking, was the state of science with respect to hydrocarbon combustion when Professor Bone re-opened the subject experimentally about fifteen years ago. He soon succeeded in a series of crucial experiments disproving the Kersten doctrine of a preferential combustion of carbon, in substitution of which he put forward the view—which has since held the field and is now generally accepted by chemists—that not only in slow combustion, but also in hydrocarbon flame, the initial attack of the oxygen upon the hydrogen involves the formation of an intermediate "hydroxylated" molecule, which then is either further oxidized in like manner, or else decomposed into simpler products according to the temperature or other conditions as set out in the following scheme:



$$\begin{array}{c} H \\ H\,.\,C\,.\,H \\ H \end{array} \longrightarrow \begin{array}{c} H \\ H\,.\,C\,.\,OH \\ H \end{array} \longrightarrow \begin{array}{c} OH \\ H\,.\,C\,.\,OH \\ H \\ \overbrace{CH_2O \quad H_2O} \\ \overbrace{CO \quad\; H_2} \end{array}$$

In a sufficient supply of oxygen the transition from the hydrocarbon to the dihydroxy stage is so rapid that no breaking-down of the molecular structure occurs in passing through the monohydroxy stage. When, however, the supply of oxygen is reduced below the equimolecular proportion, it is evident that the initial monohydroxy product cannot all be further oxidized to the dihydroxy stage. Some of it must therefore decompose, yielding, usually, steam as one product. The above theory therefore affords a complete explanation of the well-known fact that either ethylene or acetylene on explosion with its own volume of oxygen yields carbon monoxide and hydrogen without any separation of carbon or steam formation, because in each case the principal intermediate product is formaldehyde—which is a substance that decomposes straight into carbon monoxide and hydrogen at high temperatures.

Two groups of facts relating to explosive combustion which, while completely subverting the notion of any preferential combustion of carbon, harmonize very well indeed with the view of "hydroxylation."

(1) Whereas mixtures of olefines and oxygen corresponding to $C_nH_{2n} + \frac{n}{2}O_2$ behave on explosion like ethylene, inasmuch as they yield mainly carbon monoxide and hydrogen without any separation of carbon, similar mixtures of paraffins and oxygen—namely, $C_nH_{2n} + 2 + \frac{n}{2}O_2$—yield carbon oxides of carbon, methane, hydrogen, and steam, all in considerable quantities.

(2) That, even in the case of an olefine, if the proportion of oxygen be reduced below that indicated by $C_nH_{2n} + \frac{n}{2}O_2$, both carbon and steam are formed.

One of the most significant features of the experiments has been the proof afforded of the relatively greater affinity of hydrocarbons, as compared with either that of hydrogen or carbon monoxide for oxygen at the high temperature of flames. Thus, where a mixture of acetylene and electrolytic gas corresponding to $C_2H_2 + 2H_2 + O_2$ is exploded, there is absolutely no separation of carbon or formation of steam; and practically the same thing holds good in the case of a mixture of ethylene, hydrogen, and oxygen corresponding to $C_2H_4 + H_2 + O_2$. In each instance the hydrocarbon is burnt to carbon monoxide and hydrogen, just as would be the case were no hydrogen originally present in the mixture.

The foregoing work opened out the mechanism of the slow combustion of hydrocarbons, and led Professor Bone to predict that precisely similar conditions held for combustion, active enough to produce flame, and even detonation. That this prediction was open to criticism, by reason of the apparent difference possible between the molecular interaction, at comparatively low temperatures, and that existing in explosions, led to an experimental exposition of the facts as detailed below. Apparatus was accordingly constructed. Two explosion bombs were used, one cylindrical (fig. 1) and the other spherical (fig. 2), with special mixing devices, both tested to 1000 atmospheres pressure. These bombs were connected by stout tubes, through suitable cocks D, to gauges E, capable of registering small differences of pressure (fig. 3).

The whole are so mounted that quantities of pure gas from compression cylinders A (fig. 4) could, by the aid of a pump A B C (fig. 5), be forced into the bombs A (fig. 1) and there fired electrically.

Figs. 3 and 6 give the plan and elevation of the table as used in this research. C C C are the storage bombs, K is the standard Bourdon gauge, E E E are gauges reading to 100 atmospheres, D are three-way valves, and H the mixing valves.

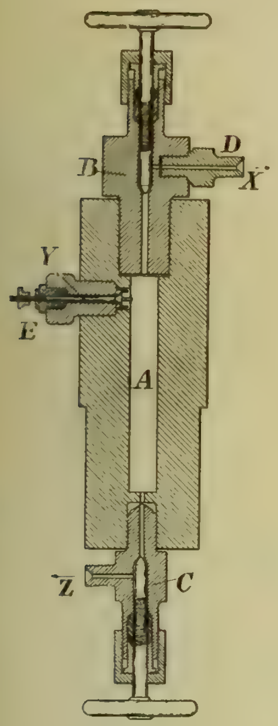
Fig. 7 is a representation of one of the four storage cylinders used. These cylinders are so soundly constructed that hydrogen at 100 atmospheres pressure can be stored for months without appreciable loss.

Fig. 5 is a pump capable of giving a capacity of 100 atmospheres, worked by hand and fitted with easily accessible valves. The pump functions in raising the mixture of glycerine and water from the reservoir G (fig. 8) and forcing it into the cylinder B for compression and subsequent transference to the cylinder C. The mixture of glycerine and water is kept in constant circulation —being alternately run out from the bottom of the compression cylinder B as each successive charge of gas is run in.

All the gases and the resultant products were carefully analyzed. After the bomb and its connections had been tested for tightness, it was exhausted and filled to five atmospheres pressure with oxygen; and, after blowing off the excess of pressure, it was again exhausted, and oxygen slowly admitted until the desired pressure was attained.

The valve of the bomb was closed, and the connections swept out with hydrogen at a greater pressure than that in the bomb, and the valve gradually turned to allow a very slow inlet of hydrogen to the desired partial pressure. The contents of the bomb were thoroughly mixed, and a sample then withdrawn for analysis. Where three gases were used in the bomb, a sample of the first two was always taken for analysis before admitting a third. The gauge readings were recorded, and the pressure registered was the bomb pressure with one atmosphere in addition, because the pressure indicated is above atmospheric.

After firing the mixture in the bomb and reducing the pressure in the connections to atmospheric, communication was established between the bomb and the gauge, which was read to within



X. To Mixing Valve and Standard Bourdon Pressure Gauge. Y. Ignition Plug. Z. To Gas Sampling Apparatus.

Fig. 1.

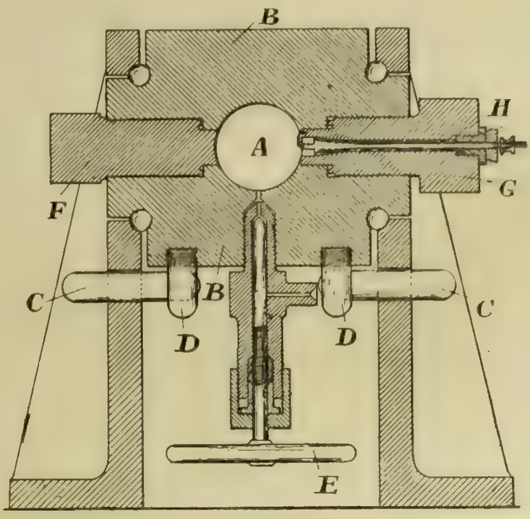
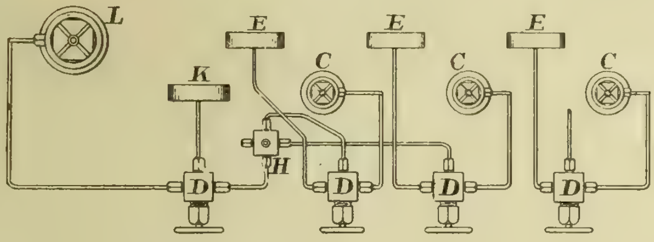
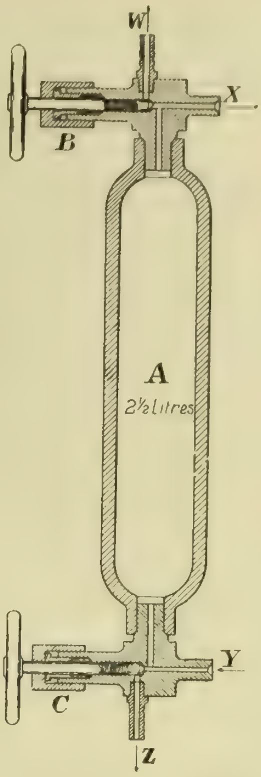


Fig. 2.



C. Storage Vessels. D. Three-Way Coned Valves. E. One-Hundred Atmosphere Bourdon Gauges. H. Mixing Valve. K. Standard Bourdon Gauge. L. Bomb "A."

Fig. 3—Plan.



W. To Twenty-litre Gasholder. X. To Storage Cylinder and Gauge, through the Three-Way Coned Valve. Y. From Compressing Pump. Z. To Reservoir for Compressing Fluid.

Fig. 4.

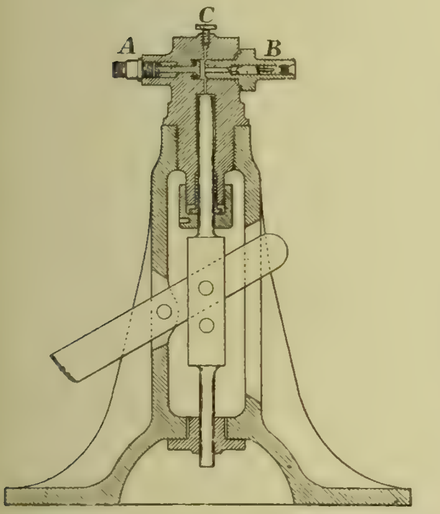
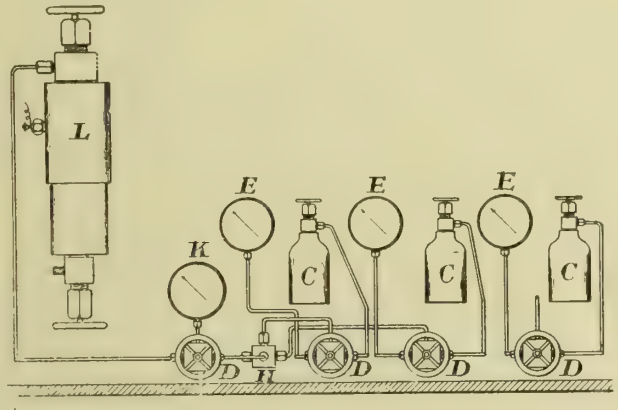


Fig. 5.



C. Storage Vessels. D. Three-Way Coned Valves. E. One-Hundred Atmosphere Bourdon Gauges. H. Mixing Valve. K. Standard Bourdon Gauge. L. Bomb "A."

Fig. 6—Elevation.

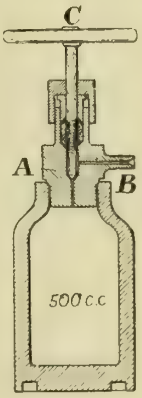


Fig. 7.

0·1 atmosphere. The reading, when multiplied by a predetermined constant and one atmosphere added, gives the pressure of the cold gaseous products in the bomb after explosion.

The above constant was the ratio of the volume of the bomb and the connections to the volume of the bomb itself. For gases, such as ethylene, which are readily liquefiable, corrections must be employed, on account of the deviation from Boyle's law.

Methane, with as nearly as possible half its own volume of oxygen, was exploded at initial pressures ranging from 8·5 to 31·25 atmospheres. The sound of the explosion up to 16·5 atmospheres is hardly perceptible; at 21·69 atmospheres, it was distinctly audible; and at 31·25 atmospheres, detonation was apparent. Carbon was deposited and steam abundantly formed in every case; and there was always a permanent increase of pressure of from 20 to 30 per cent.—the ratio p_2/p_1 increasing regularly with the initial pressure.

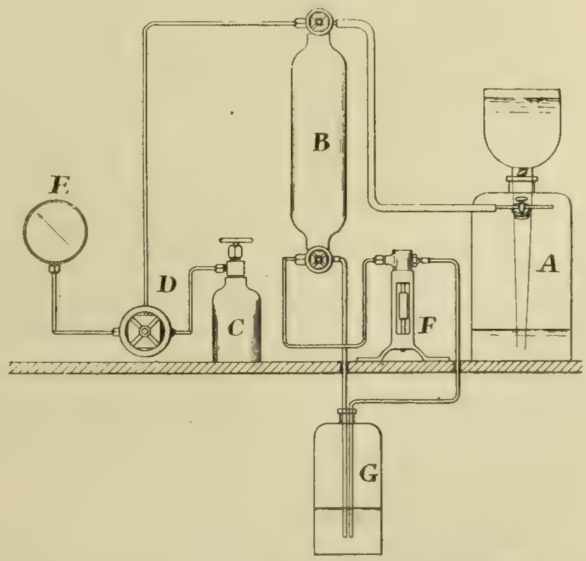
p_1 = the corrected initial firing pressure of the dry "nitrogen free" gases.
p_2 = the corrected final pressures of the cooled "nitrogen free" products.

There was an entire absence of ethylene or acetylene, yet often unchanged methane was present [*vide* table in "Phil. Trans." Series A, Vol. 215, p. 290].

The proportion of oxygen was then increased with a view to reaching a point at which no carbon was deposited; and this was observed for a mixture represented by

$$3CH_4 + 2O_2,$$

when not only was no carbon deposited with this mixture at an



A. Twenty-Litre Gasholder. B. Compressing Cylinder. C. Storage Vessel. D. Three-Way Coned Valve. E. One Hundred Atmosphere Bourdon Gauge. F. Compressing Pump. G. Glycerine and Wate Reservoir.

Fig. 8.

initial pressure of 12·6 to 12·75 atmospheres, but also the minimum quantity of oxygen occurred as steam as a result of the burning.

It may be concluded therefore that:

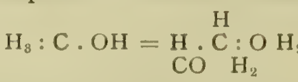
(1) The primary oxidation of the hydrocarbon is an exceedingly rapid process, and is probably completed between the ignition and the attainment of maximum pressure.

(2) There are certain secondary interactions whose influence may extend far into the long subsequent cooling period, for it is only the latter which would be affected by variations in the rate of cooling-down from the maximum temperature.

If it be considered that methane is built up of a methyl radicle—CH_3—and a hydrogen atom—*e.g.*, $H_3:CH$—then the oxygen molecule forces its way into the methane, with the result that methyl alcohol is formed,

$$H_3:C.OH$$
$$CH_3.OH,$$

and it has been definitely established that at high temperatures methyl alcohol is resolved ultimately into carbon monoxide and hydrogen without deposition of carbon or steam formation



$$H_3:C.OH = \underset{CO\quad H_2}{H.\overset{H}{C}:O\,H_2}$$

$H:C.OH$ is apparently more open to attack by a further bombardment of oxygen, with the result that the "hydroxylate"

$$H.\overset{H}{\underset{OH}{C}}.OH$$

breaks down immediately to $H\,.\,\underset{H}{C}:O$, and steam is formed.

Placing this on a thermal basis, and expressing it in kilograms-centigrade units per gram molecule, the distribution of energy is as shown:

$$\begin{tikzcd}
\mathrm{A} & \mathrm{B} & \mathrm{C} \\
CH_4 \arrow[r, "\text{oxidation}", "+30"'] & H_3:C.OH \arrow[r, "\textit{via}\ H_2:C:(OH)_2", "+59"'] \arrow[d, "-22{\cdot}8"] & H_2:C:O + H_2O \arrow[d, "-13{\cdot}4"] \\
 & CO + 2H_2 & CO + H_2 \\
 & B^1 & C^1
\end{tikzcd}$$

As the primary oxidation is extremely rapid, the impetus gathered on the journey between A and B is sufficient to carry the reaction on to C, without stopping at B or passing to B^1. In fact, from the thermal point of view, a passage from A to B^1 would involve a far less quantity of heat given out from the system by oxidation, and more heat absorbed between B and B^1, than in the case of A to C, and subsequently to C^1.

From A to B^1, *plus* 30 units are lost and *minus* 22·8 units are absorbed; whereas from A to C^1 the heat given out is (30 + 59) = 89 heat units, and only *minus* 13·4 heat units are absorbed.

Methyl alcohol requires slightly more heat for resolution into its components than does methane itself—viz., 22·8 for methyl alcohol, and 22·7 for methane; so that in decomposing methyl alcohol any methane should be resolved readily.

The following facts must be considered:

(1) The ultimate formation of large quantities of both carbon and steam in the explosion of mixture $2CH_4 + O_2$.

(2) The disappearance of carbon from the products when the proportion of oxygen in the mixtures exploded exceeds 40 per cent.

(3) The occurrence of oxides of carbon and steam in the products of all the mixtures fired.

There is no difficulty in explaining, on the lines of the hydroxylation theory, the facts comprised under (1) and (3), especially in view of the strong tendency there would always be for a non-stop run from CH_4 to $CH_2(OH)_2$ without any breaking-down at the intermediate methyl alcohol stage.

To explain the non-separation of carbon with the mixture represented by $3CH_4 + 2O_2$, it must be considered that one-third of the methane is transformed into dihydroxy methane $CH_2(OH)_2$, the other two-thirds, for lack of oxygen, not getting beyond the monohydroxy methane stage (CH_3OH), thus restricting the decompositions to either the dihydroxy or the monohydroxy methane stages in such a manner as to preclude the separation of carbon. At the stage $3CH_4 + 2O_2$, a maximum proportion of oxygen occurring as steam was found.

From the foregoing data, the authors deduce that the likely course of the secondary reactions through the relatively long cooling period, after the maximum explosion temperature has been reached, involves the reversible change

$$CO + OH_2 \rightleftharpoons CO_2 + H_2,$$

also, in the case of mixtures containing less oxygen than $3CH_4 + 2O_2$, the interaction of steam and carbon represented by $C + OH_2 = CO + H_2$, or possibly some slight interaction between methane and steam.

While evidence points to the intervention of separated carbon in the chemical interation during the cooling period, methane in no way appears to be involved therein. This conclusion is substantiated by the experimental figures, as set out in the table below for mixture $2CH_4 + O_2$, showing the ratio "R," which the sum of the oxygen as H_2O, *plus* half the oxygen, as CO_2 in the products (assuming the CO_2 to have arisen wholly from the interaction $CO + OH_2 \rightleftharpoons CO_2 + H_2$) bears to the total oxygen originally present in mixtures fired in the experiments.

The deviation of this ratio from 0·5 may be regarded as a measure of the participation of separated carbon in the secondary interactions during the respective cooling periods.

Experiments with Mixture $2CH_4 + O_2$.

Experiment No.	Initial Pressure in Atmospheres.	*k*.	R.
1	8·53	4·45	0·473
10	12·74	3 65	0·487
2	13·62	3·76	0·472
3	16·45	3·78	0·450
4	21·69	2·56	0·420
5	31·25	2·24	0·400

Experiments Showing the Relative Affinities of Methane and Hydrogen for Oxygen in Explosions, and the Conclusions Arising Therefrom as to the Mode of Combustion of Hydrogen.

The previous work has shown that when the mixture $3CH_4 + 2O_2$ is reached, no deposition of carbon takes place on explosion under pressure. In this way, a comparison of the relative affinities of methane and hydrogen for oxygen respectively, under conditions of homogeneous flame combustion, may be made. This is of great theoretical importance, because it provides a basis for the discussion of the question whether or not the known rates of flame propagation through explosive mixtures of different combustible gases are governed by their relative affinities for oxygen, and affords decisive evidence as to the mode of combustion of hydrogen in explosions.

Previous researches have shown that in slow combustion in temperatures between 300° to 400° C., methane, ethane, ethylene, and acetylene are all oxidized at a much faster rate than either hydrogen or carbon monoxide; that in exploding such mixtures with H_2 the hydrocarbon is burnt in preference to the hydrogen. If a mixture in proportions represented by $CH_4 + O_2 + xH_2$ be employed, the division of the oxygen between the hydrogen and the methane during actual combustion may be deduced from the proportion of original methane in the final products, provided there is no separation of carbon.

The experiment consisted in exploding mixtures of $CH_4 + O_2 + xH_2$, in which hydrogen and oxygen were initially present in as nearly as possible equimolecular proportions, but in which x was varied between 2 and 8, and determining the percentages of the original methane which remained intact in each case.

1. The oxygen distribution when $x = 2$.
2. The influence of successive equal increments of x up to 8; the influence of the walls of the explosion vessel upon the results.

As the hydrogen was increased, the explosion became less and less violent; and when $x = 8$, only a slight puff was heard. In no case was carbon found.

Mixtures $CH_4 + O_2 + xH_2$.

x		2	4	6	8
		Per Cent.	Per Cent.	Per Cent.	Per Cent.
Bomb A	O_2 to CH_4 . . .	95·34	81·0	54·9	31·4
	O_2 to H_2 . . .	4·66	19 0	45·1	68·6
Bomb B	O_2 to CH_4 . . .	97·10	91·0	72·6	..
	O_2 to H_2 . . .	2·90	9·0	27·4	..

The affinity of methane is at least twenty to thirty times greater than that of hydrogen, for oxygen, in explosions. The actual distribution of oxygen is influenced by the walls of the containing vessel, but not by the absolute initial pressure. Therefore the influence of successive increases in x (the volume ratio of hydrogen to methane in the mixture exploded upon the actual oxygen distribution) is, for a given vessel, proportional to x^2. This means that in explosion flames hydrogen is directly burnt to steam as a result of trimolecular impacts:

$$2H_2 + O_2 = 2H_2O.$$

It may be suggested here that this probably accounts for the observed greater affinity of oxygen for methane over hydrogen, since the oxidation of methane is due to dimolecular impacts; whereas in the latter hypothesis the oxidation of hydrogen is due to trimolecular impacts.

Experiments on the Relative Affinities of Methane and Carbon Monoxide for Oxygen in Explosions.

In this series of experiments, carbon monoxide was substituted for hydrogen, represented by $CH_4 + O_2 + xCO$. It was found that if x exceeded 3 there was a deposition of carbon, which rendered the experiments valueless for this particular work. The mixtures up to $CH_4 + O_2 + 3CO$ were exploded at an initial pressure of 24 atmospheres. It was found that between 8 and 9 per cent. of the original oxygen during the initial oxidation stage had reacted with the carbon monoxide; the remainder having allied itself with the methane. The mixtures of methane, hydrogen, and oxygen, with those of methane, oxygen, and carbon monoxide, are tabulated below.

$CH_4 + O_2 + 2H_2$.				$CH_4 + O_2 + 2CO$.		
p_1		18·314	21·12	p_1	20·90	19 44
p_2		18·1204	21·082	p_2	22 66	21·33
p_2/p_1		0·989	0·998	p_2/p_1	1·085	1·097
		Atmospheres				
Partial pressure in original mixture	CH_4	4·424	5·48	CH_4	5·184	4·870
	H_2	9·486	10·08	CO.	10·470	9·831
	O_2	4·404	5·56	O_2	5·248	4·473
		Atmospheres				
Partial pressure in gaseous products	CO_2	0·339	0·470	CO_2	1·963	1·758
	CO	4·049	5 168	CO.	14·110	13·260
	H_2	13·61	15·290	H_2	6·320	6·106
	CH_4	0·1224	0·154	CH_4	0·266	0·207
$\frac{CO \times OH_2}{CO_2 \times H_2}$		3·75	3·77	$\frac{CO \times OH_2}{CO_2 \times H_2}$	3·64	3·56
Percentage distribution of oxygen deduced from unburnt CH_4	to CH_4	97·33	97·20	to CH_4	94·9	95·7
	to H_2	2·77	2·80	to CO	5·1	4·3

The outstanding feature of the above is the greatly inferior affinity of either hydrogen or carbon monoxide compared with that of methane for oxygen. It is quite possible, in the case of hydrogen-methane mixtures, to assign a numerical relationship. Thus in the case of $CH_4 + O_2 + 2H_2$ the ratio of the affinity CH_4/H_2 is of the order of 20 or 30 to 1 at least.

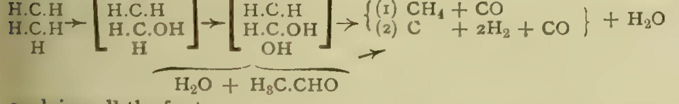
The want of information as to the precise mechanism of the carbon monoxide reaction renders a solution difficult. Nevertheless, from the comparison of the mixtures $CH_4 + O_2 + 2H$, and $CH_4 + O_2 + 2CO$ respectively, it may be observed that the carbon monoxide is more effective than hydrogen in pulling away oxygen from the methane. In the case of hydrogen, the influence of successive increments of x on the actual oxygen distribution is proportional to x^2; in the case of carbon monoxide, it is approximately x.

Here is to be discovered some fundamental difference between the modes of combustion of the two gases in flames. Where hydrogen is apparently burnt to steam, by reason of trimolecular collisions, $2H_2 + O_2 = 2H_2O$, the results with mixtures $CH_4 + O_2 + CO$ require some different supposition, such as an intermediary action of steam.

EXPLOSION OF ETHANE WITH ITS OWN VOLUME OF OXYGEN.

No theory of hydrocarbon combustion can be complete until a thorough understanding of the *modus operandi* of an equimolecular mixture of ethane and oxygen on explosion is obtained. Such a mixture should, on explosion, give rise to carbon monoxide and hydrogen without separation of carbon or steam formation, as represented by $C_2H_6 + O_2 = 2CO + 3H_2$; and as carbon monoxide and hydrogen are mutually inert in flames, the final results should not be effected by alterations in the initial pressures of the rate of cooling of the products.

Experience, however, shows that the above is not the course of the reaction; for examination of the products reveals carbon, methane, steam, aldehydic vapours, as well as oxides of carbon and hydrogen. The hydroxylation theory should predict this "non-stop" run, through the monohydroxy and the dihydroxy compounds—viz., C_2H_5OH $(OH)_2$, which decomposes, yielding aldehyde and steam—the acetaldehyde, in turn, breaking up into carbon, hydrogen, methane, and carbon monoxide, in accordance with the scheme:



$$\begin{matrix}H.\\H.C.H\\H.C.H\\H\end{matrix} \rightarrow \underbrace{\left[\begin{matrix}H\\H.C.H\\H.C.OH\\H\end{matrix}\right] \rightarrow \left[\begin{matrix}H\\H.C.H\\H.C.OH\\OH\end{matrix}\right]}_{H_2O\ +\ H_3C.CHO} \rightarrow \left\{\begin{matrix}(1)\ CH_4 + CO\\(2)\ C\ + 2H_2 + CO\end{matrix}\right\} + H_2O$$

explains all the facts.

It is well to closely examine (1) the behaviour of a mixture $C_2H_6 + O_2$, whether inflamed at less than atmospheric pressure, in glass vessels presenting varying surface areas to a fixed volume of combining gas, or detonated in a lead coil at 900 to 1200 mm. pressure, is evidence that rapid cooling favours the survival of aldehyde and unsaturated hydrocarbons, that a longer duration of the flame facilities the separation of carbon at the expense of the aldehydes and saturated hydrocarbons, simultaneously leading to the secondary reduction of steam by carbon. Nevertheless, 17 to 20 per cent. of the original oxygen appeared as steam in the final products.

A careful study in the light of the above facts was then instituted on the behaviour of the mixture when exploded in the bomb at initial pressures between 10 and 40 atmospheres. In all cases there was a deposition of carbon and condensation of steam on cooling. The ratio p_1/p_2 in the different experiments varied between 1·85 and 2·05. No acetylene or unsaturated hydrocarbons remained in the final products, although methane in considerable quantities was present. This seems to point to the fact that the violence of the explosion shatters the acetylene and unsaturated hydrocarbon molecules, while the methane remains intact.

EXPLOSION OF MIXTURE $C_2H_6 + O_2$ AT HIGH PRESSURES.

The following table is an epitome of some of the results:

Experiment No.		53.	55.	57.
p_1 atmospheres		10·90	18·55	39·65
p_2 atmospheres		20·56	37·22	73·40
p_2/p_1		1·88	2·0	1·85
Partial pressures in original mixtures in atmospheres	C_2H_6	5·54	9·20	20·15
	O_2	5·36	9·35	19·50
Partial pressures in gaseous products in atmospheres	CO_2	0·750	1·04	3·15
	CO	7·525	14·14	27·35
	H_2	10·830	19·76	34·70
	CH_4	1 635	2·28	8·20
Per cent. carbon deposited		11·7	5·0	4·0
Per cent. original oxygen appearing as H_2O in final products		19·0	13·1	13·8

There is no direct relationship between the relative affinities of methane, hydrogen, and carbon monoxide, respectively, for oxygen in hydrogeneous flame combustion, and the rates of flame propagation through explosive mixtures, in which the combining gases are present in proportion corresponding to the effective primary reactions concerned. Do such chemical factors control the rates of attainment of maximum pressures in explosions? In order to answer this question, "air mixtures," whose composition may be written:

$$CH_4+O_2+4N_2$$
$$2H_2+O_2+4N_2$$
$$2CO+O_2+4N_2$$

were used on account of the insuperable difficulties in obtaining pure oxygen mixtures. The gases were fired in the spherical bomb to which was attached a Petavel recording manometer (fig. 9). For a description of this instrument, readers are referred to the "Phil. Trans.," 1905, Series A, Vol. 205, p. 363.

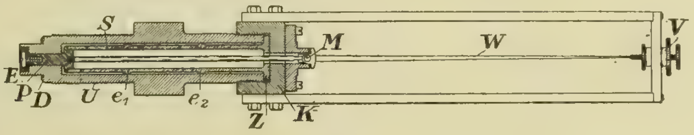


Fig 9.

The gauge is screwed into the explosion chamber by means of the thread U. The mirror M (focal length of about 2·5 feet) is attached to a lever, and at the commencement of the experiment is in the zero position, held there by the stretched piano wire W. Adjustments are made by the screw V. The source of light was an arc, and the beam was reflected on to a photographic film fixed on the drum A of the chronograph (fig. 10).

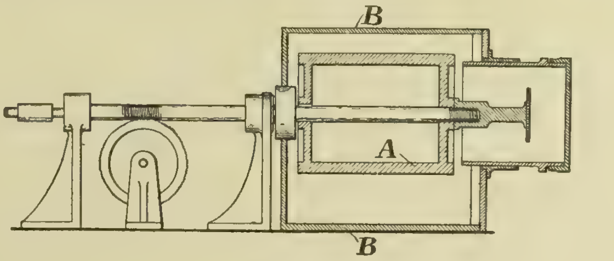


Fig. 10.

The drum is rotated at a constant speed of between 200 and 600 revolutions per minute by means of an electric motor, and is enclosed in a light-tight aluminium case B B, provided with a longitudinal slit. An electrically controlled tuning fork was used as a time indicator; the fork being so placed that each vibration momentarily interrupted the light falling on the film, thus producing a dotted record on the pressure curves.

It became evident from these experiments that the hydrogen air mixture is the "fastest burning;" the maximum pressure being reached in approximately the time taken by the slowest burning mixture—viz., carbon monoxide—air (*i.e.*, 0·01 second, as compared with 0·10). The time required in the case of the methane-air mixtures (0·05 to 0·08 second) was at least five times as long as the hydrogen-air mixtures, notwithstanding the fact that the affinity of methane is twenty times as great as that of hydrogen for oxygen in flames.

Apparently, therefore, there is no relationship between the actual rate at which the potential energy of an explosive mixture is transferred on explosion as sensible heat to its products and the magnitude of the chemical affinity between its combining constituents.

The extreme slowness of the cooling, after the attainment of maximum pressure, is evident from the curves, figs. 11, 12, and 13, which are plotted with pressure measured in atmospheres as ordinates and time in seconds as abscissæ.

This was particularly marked in the case of the methane-air mixtures, in which there was hardly any appreciable cooling during an interval of 0·22 second after attainment of maximum pressure. The circumstance may possibly be attributed to: (1) The combustion taking place in well-defined chemical stages, and also (2) the operation of the endothermic secondary interaction between carbon monoxide and steam during the cooling period. The cooling is rather more rapid in the case of carbon monoxide air mixture, and still more for the hydrogen air mixture.

In conclusion, then, it is definitely proved that: (1) Methane has a greater affinity for oxygen than either hydrogen or carbon monoxide. (2) There is no direct relationship (if any) between the relative times required for the attainment of the maximum pressure and the relative affinities of the combustible gases respectively for oxygen.

E. S.

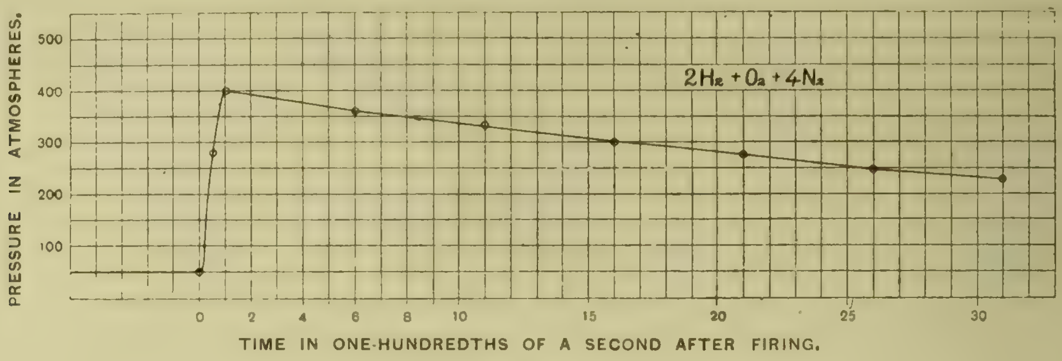


Fig. 11.

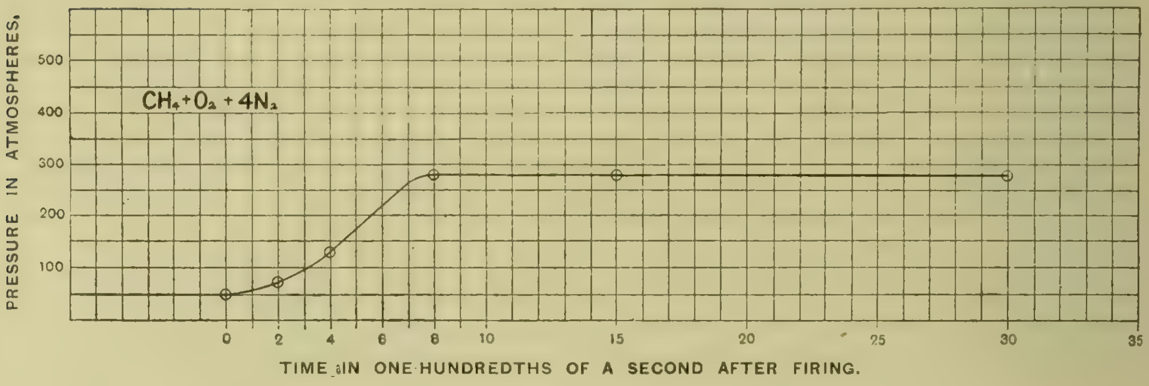


Fig. 12.

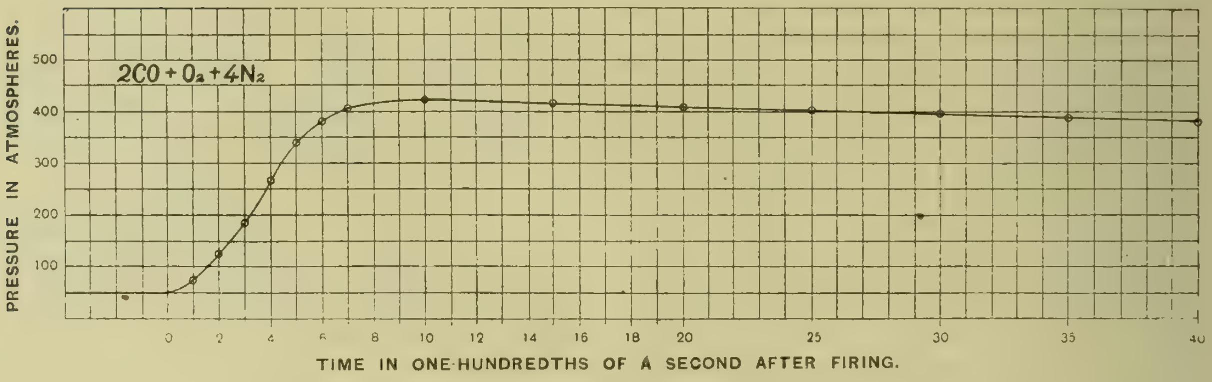


Fig. 13.

GAS-ENGINES AND THEIR CAPACITY FOR DEALING WITH PEAK-LOADS AND OVERLOADS.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

In an article, on "Power Production—the '*£ s. d.*' of the Question," published in the July 13 to Aug. 3 issues of the "Journal" last year, the author expressed the view that individual driving by electric motors could not, so far as the small factory proprietor was concerned, be regarded in the light of a commercial proposition, in view of the fact that each motor has to be rated so as to be capable of handling the maximum load provided by the machine to which it is coupled, and that it would consequently be operating for the greater portion of its time under an uneconomical load factor.

This statement was severely handled by one of the Electrical Journals, whose reviewer, in the course of his criticism, remarked that, "if anything is clear from these rather muddled sentences, it is that Mr. Widlake is ignorant of the overload capacity of the electric motor. Moreover, he says nothing of the fact that when a works is driven by a gas-engine, that engine which has no overload capacity worth mentioning must be equal in capacity to the maximum demand of the factory, although the average demand may be and would be, in the vast majority of cases, very much less." This criticism was dealt with at length in an article, entitled "Overload Capacity and Individual and Group-Driving," published in the "Journal" for Aug. 24.

The author has recently been engaged upon a series of observations in connection with the plant at a local power laundry, and the results of these observations have been so utterly at variance with the latter portion of the above-quoted criticism as to quite warrant their publication in further answer to the contention of the electrical enthusiast that a gas-engine has no appreciable overload capacity.

The laundry in question has already provided interesting data for readers of the "Journal," in connection with some rather striking economies which were effected by the replacement of an electric motor by a gas-engine in connection with the driving of hydro-extractors. In the article referred to [June 22, 1915] brief mention was made of the low cost at which a 15 B.H.P. gas-engine operated all the other machines in the building; and in the present article it is proposed to deal with the actual maximum demand created by these machines, and to consider this maximum in conjunction with the rated horse power of the gas-engine.

The following list shows the machines with which each floor of the laundry is equipped; and against each machine is placed its maximum demand.

GROUND FLOOR (WASHHOUSE).

[Excluding the two 38-inch hydro-extractors driven by a 6 B.H.P. gas-engine.]

One 26-inch hydro-extractor	2·5
One 24-inch ,, ,,	2·5
One 250 shirt washing machine	2·5
Three 200 shirt washing machines, at 2 H.P.	6·0
One 100 ,, ,, ,, ,,	1·0
One 80 ,, ,, ,, ,,	1·0
Two "Vowel" washers, at 1½ H.P.	3·0
Total maximum H.P. required	18·5

FIRST FLOOR.

One 108-inch "Decoudin"	2·0
One 40-inch ,,	2·0
Two 108-inch callenders at 2 H.P. each	4·0
One 36-inch fan	1·25
Total maximum H.P. required	9·25

SECOND FLOOR.

Four collar machines at ¼ H.P.	1·0
Two shirt machines at ¼ H.P.	·5
Two goffering machines at ⅛ H.P.	·25
One shirt banding machine	·125
One collar curling machine	·125
One starching machine	·25
Two 12-inch fans at ¼ H.P. each	·5
Total maximum H.P. required	2·75

Summarizing, the maximum demand for power which these three floors may create, provided that the maxima of the individual machines occur simultaneously, will be as follows [neglecting transmission loss for the moment]:

Ground floor	18·50
First floor	9·25
Second floor	2·75
Maximum demand	30·50 horse power

Under the actual working conditions pertaining in this laundry, the three floors are working together five days of the week, while for the remaining two days at least 60 per cent. of the average demand for power maintained during the five days is required. Large Government contracts are held, which necessitate working through the week-end; and the character of the materials handled in connection with these contracts is such as to tax the washhouse machinery to its utmost.

The load of the three floors is dealt with by a gas-engine, built in 1905 and rated at 15 B.H.P., which drives direct on to the washhouse main-shafting. A belt-drive from this main shafting drives the overhead shaft on the first floor, from which the callenders and "Decoudins" take their power, and from which the small finishing machines on the top floor are under-driven. The power from the gas-engine to these various machines is transmitted *viâ* 170 feet of shafting (including five countershafts), 32 plummer blocks, and 52 belt-drives.

It is rather difficult to decide exactly what amount of power is absorbed by the above transmission details, but it is certainly not less than 4 to 5 B.H.P. Assuming this loss to be represented by the very low figure of 4 B.H.P., we may now say that the maximum demand alluded to in the criticism mentioned at the beginning of this article is 34½ H.P.

We have been told that "when a works is driven by a gas-engine, that engine which has no overload capacity worth mentioning must be equal in capacity to the maximum demand of the factory." We have here a load whose possible maxima (on which basis we are told the engine should be rated) are about 34 B.H.P., which for years has been satisfactorily handled by a 15 B.H.P. gas-engine. The diversity factor seems all on the wrong side, yet the job goes on all right. There are no complaints; the engine shows no sign of distress, never pulls up, and does not overheat.

In the article on the driving of hydro-extractors published in the June 22 issue of the "JOURNAL," the running costs for this engine for the year ending Michaelmas, 1914, were shown to be very low—namely, 5½d. per hour. During the twelve months ending Michaelmas, 1915, the price of gas in the district was advanced by about 19 per cent.; but, while the running hours of the engine under the same load have been greater than during the preceding twelve months, the costs per hour are only about 5·8d., including interest, depreciation, and lubrication.

The following figures show the result of a series of observations taken recently of one day's run of this engine:

Meter reading—Dec. 29, 1915, 11 a.m.	991,900 cubic feet
Dec. 30, 1915, 11 a.m.	994,800 ,,
Gas consumed	2,900 cubic feet
Working hours	10½
Gas consumed per hour	280 cubic feet
Average load, assuming an engine efficiency of 20 cubic feet per B.H.P. hour	14 B.H.P.

Now it seems fairly obvious that the individual maxima of the various machines rarely occur simultaneously. But on the other hand it is equally obvious that with such a plant being run at its utmost capacity, there must be constantly recurring peak-loads, whose effect must be to tax the engine far beyond its rated power; and in view of the fact that stoppages due to overload are practically unknown the question naturally arises, "How are such peak-loads met?" The answer is, by the overload capacity which all well-designed gas-engines possess, and which for obvious reasons is always belittled by those interested in electrical driving. By virtue of the energy stored up in the heavy revolving rim of the gas-engine's flywheel the machine possesses a tremendous capacity for dealing with the momentary peak-loads which are so constantly arising in a factory of this kind.

Overloading is a prolific cause of breakdowns among electric motors. But a gas-engine cannot be overloaded in the same sense of the word as can an electric motor, and for these reasons: The immediate result of an overload on an electric motor is a drop of speed, and hence of counter or opposing pressure, as a result of which an increased current passes through its windings, the purely ohmic resistance of which is insufficient to prevent the passage of a destructive current. Assuming the continuance of a bad overload, this current is only limited by the melting point of the fuses in circuit. This current will probably pass through two sets of fuse-boxes, one pair under the control of the electric supply authorities and one pair embodied in the motor control-gear and in the charge of the machine attendant. The fuses in the boxes under the control of the supply authorities will be rated on the maximum demand of the building, and will not, generally speaking, blow on account of a fault on one individual machine.

It consequently follows that the current passing through the windings of the overloaded motor will be limited by whatever happens to be connected across the terminals of the motor fuse-boxes; and those who have had experience of electric motors operating under the charge of handy men will quite understand why the author prefers to refer to the contents of the boxes in this very vague manner. It may be wire nails, hair pins, copper, brass, or iron wire; but the last thing one would expect to find is a properly rated fuse.

Now the motor has, generally speaking, an unlimited supply of power behind it, and will continue to draw on this supply far in excess of its rated safe load, until its fuse blows and brings it, together with the load to which it is coupled, to a standstill.

Let us take now the case of the overloaded gas-engine. The maximum power it is capable of exerting is dependent upon the number of maximum impulses it is receiving per minute. While like the electric motor it may have an unlimited supply of raw power behind it for conversion into mechanical energy, the very principles on which it operates enable it to protect itself against the injurious consequences of a heavy overload.

A well-designed gas-engine is rated upon a normal working load and has a certain reserve of power (say from 15 to 20 per cent.), which is always available for dealing with any excess demand which may arise. The immediate result of an overload on a gas-engine is a tendency on the part of the machine to slow-up; and the energy stored up in the heavy revolving rim of the flywheel will commence to expend itself in an attempt to meet the increased demand.

If the overload be just momentary, the fly-wheel effect will be sufficient to carry the engine over this period of increased demand; and as soon as the load again falls to normal, the engine will work itself up to the speed at which it was running before the occurrence of the overload. But if, on the other hand, the demand for extra power is not a peak-load of merely short duration, the speed of the engine will fall to the point at which the governors come into operation and increase the number of explosive strokes in the case of an engine governed on the "hit and miss" principle or the strength of the charge in the case of a throttle-governed machine.

The greater portion of peak-loads in factories is brought about by the starting-up of standing machines—thus causing a demand for power to accelerate these machines from a state of rest to full speed. The power required for this purpose may be many times greater than the power actually required to keep the machines running when once full speed has been attained. After the machines have been started, the engine will, of course, take a little more gas, in order to deal with the legitimate increase in load caused by the putting of the machines to work; but the increased power required for starting them from a state of rest is mostly met by flywheel effect.

There is a limit to the overload which any prime mover can sustain without injuring itself. A gas-engine slowing-up under an overload takes more and more power, by virtue of its governing principles, until this limit is reached, when, if the speed still continues to fall, so likewise does the power supplied to the engine fall off, and so save the machine from that rush of raw power which, under the conditions, it cannot convert into mechanical energy without detriment to itself.

Now in the case of an electric motor this limiting point is not in any way fixed by the design of the machine, but is dependent upon the rating of the fuse. An electric motor slowing-up under an overload will take more and more current from the supply mains as the speed falls; and if the fuse, for any reason, fails to act, or does not act at the proper current value, the result will probably be that the insulation of the windings will deteriorate to a great extent (even if the windings have not been actually burnt-out), owing to the heating effect due to a much greater current than the motor was designed to operate under.

The statements set forth in this article relating to the 15 B.H.P. gas-engine are confirmed by the conditions under which the laundry referred to was worked prior to the installation of the engine. The business started in 1896 with a 6 B.H.P. gas-engine, and a load of certainly not less than 20 B.H.P. (based on the sum of the individual maxima of the machines installed). For nine years the little engine handled the load, and only in 1904 (when the management were considering the putting down of some extra machines) was it decided to replace it by a larger engine. For some years the engine lay idle most of its time, being merely regarded as a stand-by; but in 1914 it was put into service for the driving of two 38-inch hydro-extractors, as described in the "JOURNAL" for June 22 last. Since that date it has been on this load for 10 hours a day, 300 days per year, and runs at an efficiency of 24 cubic feet per B.H.P. hour. So that the experience of the user of this engine can hardly be said to be that its efficiency has decreased largely with age.

The cases of these two engines are simply ones which happen to have come under the writer's notice, and are plain statements of facts open to any inquiry or investigation. There are thousands of such cases in all parts of the country—cases in which old gas-engines, which by all the rules laid down by electrical men for their depreciation should now be on the scrap-heap, are giving excellent service, year in and year out, with a degree of reliability and economy which cannot be equalled, much less excelled, by any other type of the latest power generators.

Particulars such as those given in the preceding paragraphs are unfortunately difficult to obtain; and the author cannot help thinking that it would be well worth the while of gas-engine manufacturers to get together some data regarding their clients' engines, and make use of the same in their publications. If this were done, perhaps we should hear less of the misleading statements made by electric motor manufacturers in regard to the relative overload capacities of the gas-engine and the electric motor.

REPAIRING A SHELL-DAMAGED GASHOLDER AT LILLE.

THE "Journal für Gasbeleuchtung" of Dec. 25 gave a report, dated Aug. 1, 1915, by Captain Westphal, the Chief of the Electrical Section of the German Army at Lille, on the repair of a gasholder in that town in Northern France, which had been somewhat damaged by shell-fire in the bombardment of the town in October, 1914.

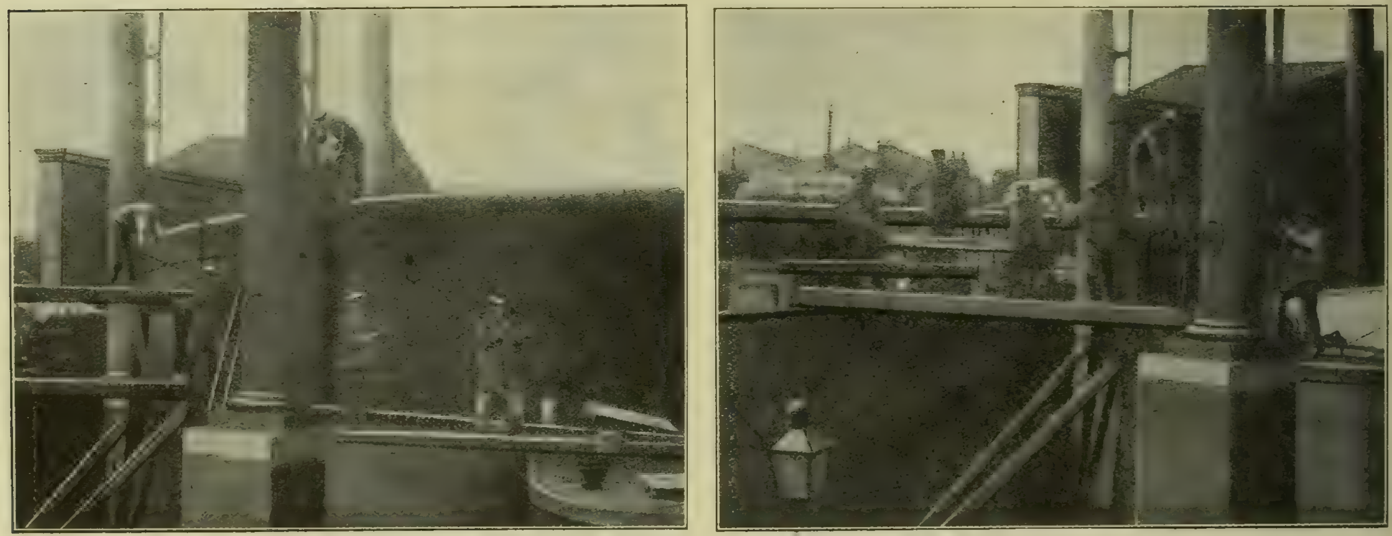
The gasholder, which has a capacity of 127,000 cubic feet, is at the St. André sub-station of the gas undertaking, in the Rue de la Caserne. It is a two-lift holder; and at the time it was struck it contained about 106,000 cubic feet of gas. A shell penetrated the side of the top lift, 40 inches below the top curb, causing a hole as big as a man's fist. It did not, however, ignite the gas at this hole. It burst in the holder, about 5 feet from the cup, and ripped in the side sheets a hole about 32 inches long and 24 inches wide. Fragments caused about seventeen holes, small and large, in the side of the upper lift. The gas issuing from the hole caused by the shell-burst ignited, and produced an enormous jet of flame which extended across the street (which is 40 feet wide) and set fire to the woodwork of a house on the opposite side. The gasholder was emptied in a few minutes, and there was no big conflagration.

Though the works of the gas undertaking together had still sufficient holder accommodation, it appeared desirable to restore the holder to a usable condition, as it had to be borne in mind that at any time another gasholder might be destroyed by hostile artillery or bombs from aircraft. The gas and electricity works (the report states) appear to present a special attraction to the airmen, as bombs have twice been dropped in the immediate neighbourhood of the Wazemmes Gas-Works on the Boulevard Montebello, without, however, doing damage to the gas-works itself.

In order to repair the gasholder, it was necessary to raise the inner lift, which weighed about 16 tons, sufficiently high to give room to work between the bell and the wall of the masonry tank. Lifting appliances for raising the bell as a whole were not available; and recourse was therefore had to the following expedient. The tank, which was 26 ft. 3 in. deep and contained about 530,000 gallons of water, was first emptied by an 8-horse power petrol engine driving a centrifugal pump and a pulsometer. In default of large pulley blocks, six wooden trestles were set up between the guide columns; and on each of these was placed a cross-bar consisting of a long square baulk of timber. To one end of the cross bars, forming the arms of levers, were attached (by 5-feet screws) pendants of stout flat iron, 26 ft. 3 in. long. In order to balance the weight of the bell and the iron pendants, the other end of each cross-bar or lever was loaded with thirty large sacks of sand. The end of each pendant was bent round so as to form a hook, with which the bell was gripped, and then raised about 10 ft. 6 in. by the six spiral screws uniformly applied.

For greater safety, the bell was then propped up by six cross-head piles, and the holder being empty both of water and gas, it was then convenient and safe to work both from the inside and in the space between the bell and the wall of the tank. The tackle used was partly procured from a boiler works at Fives, and partly prepared in one of the shops of the gas-works. The work was carried out in about four weeks by the electrical section of the militia (under whose officer the administration of the gas-works has been placed) and the ninth company of garrison railway engineers. When the damaged plates had been renewed or repaired, the holder was cleaned and painted by civilian labour, and then again brought into action.

The two illustrations from our contemporary show the holder in course of repair.



REPAIRING A SHELL-DAMAGED GASHOLDER AT LILLE.

SOME PRINCIPLES IN INDUSTRIAL LIGHTING.

At the Meeting of the Illuminating Engineering Society last Tuesday, at the Royal Society of Arts, Mr. J. S. Dow read a paper on the above subject, with special reference to the report of the Departmental (Home Office) Committee on the Lighting of Factories and Workshops. The paper was of considerable length; and we give here only the principal points.

The object of the paper is to show, by a few typical examples, how the requirements of the Home Office Departmental Committee's Report on Factory Lighting can be readily met by modern methods, and to summarize the situation as regards planning installations.

Adequate and suitable lighting, it is suggested by the report, should comply with the following requirements: (1) Adequacy. (2) A reasonable degree of constancy and uniformity of illumination over the necessary area of work. (3) The placing or shading of lamps so that the light from them does not fall directly in the eyes of an operator when engaged on his work, or when looking horizontally across the workroom. (4) The placing of lights so as to avoid the casting of extraneous shadows on the work. In addition, there are the provisions 2 to 7 in the report, relating mainly to the minimum degree of illumination (0·05 to 0·4 foot-candle, according to circumstances), which is considered necessary in the interests of safety.

PROVISION OF REQUIRED ILLUMINATION.

As to adequacy, it may be presumed that the amount of light for carrying on work would only be deemed inadequate when it was obviously below the standard usual for the process in question, and manifestly a hindrance to the worker. We have, however, in Vol. III. of the report, some excellent information as to the conditions which already exist. One of the first things which strikes one in reading these data is the variety in the amount of illumination afforded in different factories for similar processes. It is evident that a general agreement as to standards would be very helpful in removing these anomalies. Lighting experts would probably agree that the average values of illumination recorded in these tables could be quite easily provided by modern methods without undue expense; and possibly these averages might furnish a rough indication as to the amount of illumination desirable for the class of work.

After examining the figures, one appreciates the wisdom of drawing a distinction between the general illumination necessary in the interests of safety, and the illumination for the carrying out of work. The existence of a moderately high illumination at floor-level does not imply that the illumination on the work is ample. Conversely one may find a high illumination on the work but very little on the floor. On the other hand, when the nature of the work and the arrangement of the machines render it desirable to aim at a high general working illumination throughout the room, one usually provides this illumination by means of sources mounted near the ceiling. In such cases, the mere fact of providing adequate illumination for the work should ensure that the minimum value in the interests of safety and convenience will be everywhere exceeded.

These conditions are probably more typical of factories in London than the mills and workshops, covering a very extensive area, in the provinces. I think, however, that even in large covered areas, where there are spaces between the points where work is done, and where it would be uneconomical to flood the entire floor-area with light, there ought to be no difficulty in providing sufficient to ensure a minimum of 0·25 foot-candle; and in practice 0·5 foot-candle might be aimed at. Probably there are few cases in which a system of general lighting would be installed with the deliberate intention of producing an even general illumination of this value. From the discussion at the meeting on Nov. 23, it would appear that the general illumination prevailing in modern factories is apt to be over-estimated. A general illumination of 3 foot-candles appears to be extremely rare. From the report, it is seen that 2 foot-candles was only attained in 3 per cent. of the factories visited, while 28 per cent., or nearly a third, fell below the minimum of 0·25 foot-candle suggested. If, therefore, all factories were brought up even to this level, a substantial improvement would have been made. The well-known booklet on industrial illumination, issued some years ago by the National Electric Light Association, summarized the usual practice for various trades in a very admirable manner. After examining these figures closely, one is inclined to think that perhaps it is hardly necessary, with our present knowledge, to attempt to discriminate quite so closely between the requirements of different operations as in this production. The following rough classification contained in the recent code prepared by a Committee of the American Illuminating Engineering Society might perhaps serve as a useful guide:

Class of Work.	Minimum Illumination Foot-Candles.	Desirable Illumination Foot-Candles.
Storage, passage-ways, stairways, and the like	0·25	0·25—0·5
Rough manufacturing and other operations	1·25	1·25—2 5
Fine manufacturing and other operations	3·5	3·5 —6·0
Special cases of fine work	—	10—15

It may be suggested that almost all industrial operations might be classified under one of these heads, so far as the amount of illumination required is concerned. It should be particularly noted, however, that merely specifying a certain illumination on the work is not enough to secure "adequate and suitable lighting." The illumination must also comply with the requirements stated above as regards uniformity of illumination over the working area, avoidance of glare, and avoidance of inconvenient shadows. The provision of a uniform illumination is mainly a matter of arranging the lighting units at suitable distances apart, according to their distribution curves; and wherever it is necessary to light a large area equally at all points, a high standard of uniformity can be obtained. In such cases a variation of not more than 25 per cent. on the work might perhaps be anticipated.

AVOIDANCE OF GLARE.

The next consideration, the avoidance of glare, is an exceedingly important one. This is the requirement which, of all others, is apt to be disregarded in factory lighting; and Vol. III. of the Home Office Committee's report contains frequent objections to installations on this ground. Yet, so far as those who scheme factory installations are concerned, there is now general agreement that glaring points of light within the range of vision should be avoided, and the explanation of defective installations lies more often in the indifference of the public who have not yet learned that exposed brilliant lights are necessarily wasteful, and even insist on them. By the aid of modern appliances, it should be practicable in almost every variety of installation to comply with the Committee's suggestion—viz., "the placing or shading of lamps so that the light from them does not fall directly on the eyes of the operator when engaged on his work or when looking horizontally across the workroom." The installations where it would probably be most difficult to meet this requirement are those carried out in rooms with rather low ceilings. However, seeing that the use of an appropriate reflector almost invariably tends to increase the light on the work, there is clearly no hardship in asking that such lights should be screened.

AVOIDANCE OF INCONVENIENT SHADOWS.

The last requirement, relating to the avoidance of inconvenient shadows, is clearly one the application of which will have to be studied by practical experience. For the present, no doubt it would serve chiefly to enable inspectors to advise managers of factories to make small adjustments in the positions of lamps, &c., in cases where the wrong direction of light, by causing a deep shadow, was obviously causing inconvenience to a worker, or a possible source of danger. As instances, one might mention the presence of an inconvenient shadow at a cutting edge or circular saw, or the shadows thrown by projecting masses of machinery causing moving parts to be in semi-darkness.

PREDICTION OF ILLUMINATION.

As to whether it is practicable to determine in advance the actual illumination that will result from a given arrangement of lighting units in specified positions—to make sure, in fact, not only that the requirement as regards the minimum general illumination for safety in working areas is satisfied, but that the illumination at the point of work is also ample—to those who are responsible for the planning of lighting installations, it may seem almost superfluous to raise this question. It was conclusively shown, in a paper by Mr. Clinton before this Society in 1914 that, by taking sufficient care, the illumination obtainable may be calculated with considerable accuracy. But the fact that it was recently stated in a leading technical journal that "no one can calculate beforehand how much light will be required and how much will be obtained by any suggested arrangement," shows that the resources of modern illuminating engineering in this respect are not sufficiently widely known. The view that illumination can be pre-determined with sufficient accuracy for practicable purposes was endorsed by a number of witnesses before the Committee, representing both gas and electric lighting.

A few years ago, it would certainly have been difficult for any engineer to make these calculations without preliminary tests of the lighting units he proposed to employ. But at the present time leading companies issue polar curves of light distribution of their standard units; and it is therefore easy to calculate not only the illumination immediately under the lamp when hung at a prescribed height, but also the illumination at a given distance from it. If a lamp hung at a height h, gives a candle power I in the direction immediately below it, the resultant illumination under this lamp is I/h^2. If we next select a spot at a distance r from the point immediately below the lamp, and if the candle power in that direction is I_θ, the resultant horizontal illumination is:

$$E = \frac{I_\theta}{h^2}\cos^3\theta = \frac{I_\theta . h}{(h^2 + r^3)^{32}}$$

There are formulæ which are perfectly familiar to lighting engineers, and can be applied by anyone with engineering knowledge. If we are dealing with two lamps in a row we can, by using the above formula, obtain the illumination from either, at any point between them, and (by adding up) the resultant illumination due to both units.

Makers of modern lighting appliances, however, have simplified the calculations by furnishing information regarding the best relations between the height and distance apart of lamps in order to secure even illumination. Three distinctive types of distribution curves, corresponding with "extensive," "intensive," and "focusing" reflectors have been adopted; and anyone who adopts these methods can see from the data provided what the direct illumination with the lamps at a given height may be. It is true that, in practice, one cannot always adhere to these rules exactly; but, as a rule, the deviation resulting from a departure need not be large, and can, with a little trouble, be allowed for. In passing, I should like to mention that, while one can easily get full information of this kind regarding direct lighting, similar data for indirect lighting are not usually obtainable.

It will be observed that what is said above refers to the direct illumination from the lighting units, and takes no account of light reflected from walls and surroundings. It is here that less certainty is felt, although the experienced can form a very fair estimate of the added illumination, with a known type of lighting. The following rough rule, given in the American "Code on Factory Lighting," is certainly worth bearing in mind: "With modern lamps, roughly one candle power per square foot produces an effective illumination of three foot-candles when the lamps are arranged according to the uniformly distributed overhead system, with mounting heights ranging from 12 to 16 feet above the floor, and when the light is directed from the lamps to the work in an efficient manner."

The writer, as the result of tests in average interiors during recent years, has been accustomed to reckon general lighting installations on the following approximate basis. Naturally the data only apply to cases in which an even general illumination is aimed at, and typical properly designed lighting units are used. They are also subject to some modification when one is dealing with very large or very small interiors. But they are fairly useful as a rough preliminary guide :

System of Lighting.	Specific Consumption per Lumen on Working Plane. Cub. Ft. per Hour per Ft.-Candle per Sq. Ft. Illuminated.
GAS.	
Direct—	
Low pressure	0·01 —0·02
High pressure	0·003—0·1
Indirect—	
Low pressure	0·02 —0·04
High pressure	0·005—0·02
	Watts per Ft.-Candle per Sq. Ft. Illuminated.
ELECTRICITY.	
Direct—	
Tungsten lamps	0·2 —0·3
White arc and half-watt lamps	0·1 —0·2
Flame arc	0·05 —0·1
Indirect—	
Tungsten lamps	0·4 —0·6
Arc and half-watt lamps	0·2 —0·4

In these cases the illumination referred to is that on the working plane. But it must not be inferred that the light directed on the surroundings is wasted. In many cases where the illumination of large vertical surfaces, diagrams, shelves, &c., is important, the additional illumination shed in these directions by indirect and semi-indirect systems is a compensating advantage for the relatively lower illumination, for a given energy expenditure, on the working plane. It may be observed that the proportion of the total amount of light reaching the working plane tends to increase as the area illuminated increases, assuming that lamps are kept at the same distance apart. For this reason one finds that in very extensive installations higher values of illumination are obtained than one at first sight would expect. At the other end of the scale one finds that very small interiors, with light walls, also give high results because much of the light emitted sideways is redirected on to the working plane.

GENERAL, LOCAL, AND LOCALIZED GENERAL LIGHTING.

Both in framing rules for the calculation of illumination, and in devising recommendations regarding the arrangements of lamps with respect to work, the avoidance of glare, &c., one has to draw a distinction between general and local lighting. There is no doubt that the line of demarcation between these two methods has shifted considerably during recent years. General illumination is admittedly the best system for a workroom when it is desired to illuminate the entire area of the place equally well all over. When a room is almost completely filled by rows of workers engaged on identical operations, one should clearly aim at a well-diffused flood of illumination over the working area. It was formerly the custom to treat such rooms by pendant lamps over each individual machine or group of machines, to allot so many lamps per bench, &c.; the lights provided being usually of relatively small candle power, and mounted only a few feet above the working level in the room. The development of more highly efficient gas and electric units during recent years has, however, quite changed this problem. The tendency now is undoubtedly to use more powerful lamps, if necessary, in suitably concentrating forms of reflectors, and to place them high up near the ceiling, at the same time taking full advantage of the reflecting power of light surroundings. This "overhead system" does away with all long lengths of wire or piping, and leaves the room completely clear. This system is advantageous from the standpoint of avoiding inconvenient shadows, and it has the great merit that the position of benches and machinery can be altered without it being necessary to rearrange the positions of lamps. But there still remain very many operations where a local light is needed—chiefly cases where the illumination must reach an exceptionally high value. One point in connection with local lighting may be insisted upon—the provision of a moderate general illuminant in addition to the strong local lighting, so as to avoid undue contrast between the illumination of the work and the surroundings. A general value of at least 0·5 to 1 foot-candle might be suggested. On the other hand, when general illumination is used, one must guard against too little contrast. One frequently hears it said that the eye likes to be "rested" by the gaze being transferred from the brightly illuminated work to the subdued surroundings. The physiological basis of this problem is still obscure, and requires further study.

As an instance of an industry where local lighting seems likely to be replaced by general illumination, one may take clothing factories. Here we usually find that an entire room is occupied by rows of sewing-machines doing almost identical operations; but the illumination requires to be exceptionally high, especially when dark materials are used, and local lighting has therefore been hitherto largely employed.

The varied applications of local and general lighting are well exemplified in machine shops. In an erecting shop a good general illumination is necessary as a basis. Even here, however, portable lamps may be desirable for close inspection of special work, while it would generally be agreed that lathes and benches require either local or localized general lighting. For fine work, ability to adjust the position of the light is of importance. Automatic machinery is really a special case in itself, in view of the fact that the special local illumination is really only required in setting the tool and arranging the work. Once the machine is set in operation, a moderate general illumination suffices. This illustrates the distinction between "inspective" and "detective" work drawn by the Committee.

Another circumstance that has favoured the use of general illumination for factory lighting is the simplification of machinery and the diminution of shafting and belts. Generally speaking, in machine-shops where there are a large number of moving belts and overhead shafting general lighting is inapplicable, owing to the interruption and flickering shadows caused by these moving objects; local lighting must therefore be used. The same applies to weaving rooms in textile mills, except that the method in this case might more fitly be described as localized general lighting, seeing that one light is commonly allotted to two or four looms. But here again in the very latest mills the obstruction to light from above has been diminished, and a well-diffused system of general lighting might in this case be practicable.

Points from the Discussion.

The CHAIRMAN (Mr. F. W. Goodenough) said members were much indebted to Mr. Dow for his comprehensive, interesting, and well-illustrated paper, which was rather informative than controversial; and called rather for study than for discussion. The only point he had noted for comment was Mr. Dow's query whether local or general lighting was desirable for offices, banks, and so forth. With the possibility nowadays of getting good general illumination at moderate cost, he (the Chairman) thought the desire for local illumination would largely die out. But this all depended on the intensity of application to the work that was called for, because in the case of all work demanding intense concentration of the eyes upon the work for lengthy periods—such, for instance, as the sorting of letters—the workers usually found it was restful to be able to glance up occasionally from the work on which they were engaged to a darker surrounding than the surface on which their eyes had been fixed. This they could not do if the surroundings were all illuminated to an equally high degree. He believed at the General Post Office it was found necessary, at the request of the sorters, to moderate the general lighting, in order that they might get rest for their eyes when looking up from sorting work. His own experience in office work was that he found general illumination (his office was lighted by a lamp in the ceiling) was perfectly satisfactory; and he had done away with an old desk lamp, at one time thought indispensable.

Mr. H. C. WHEAT showed a large number of lantern slides, some of which were intended to evidence that general lighting could be very effective at the working or any other plane, if proper care was taken in its installation. The question of diffusion, he said, was of paramount importance in securing satisfactory lighting; and yet it was one of the things that was most often neglected or overlooked. Mr. Dow had referred to shadows, and the direction of the light. He (Mr. Wheat) ventured to suggest that it did not matter how careful one was about placing the lights, shadows would annoy, if satisfactory diffusion was not obtained. But if good diffusion were secured, the shadow question receded more into the background. Upon the subject of local and general lighting, his own experience was that general lighting would not prove satisfactory for some classes of work—for instance, such as sewing-machines, where the upper part of the machine, with general lighting, threw a shadow on the work being done. With general lighting the shadow from the machine was insurmountable, and a serious objection. In such a case, they must have local lights.

Mr. C. C. PATERSON (National Physical Laboratory) wished to endorse nearly everything Mr. Dow had said in his paper, and also to warmly thank him for it, because it brought out various points in a very full way, which could not be put in so many words in a Government report. There were one or two things mentioned which struck him (Mr. Paterson) as points that were not always considered. The author mentioned in one place that people in America paid a good deal of attention not merely to the whitening of the walls of their factories, but to the whitening of the machines and the floors. How the whitening of floors was carried out was a most important point. It would be an easy matter to supply a minimum illumination if the floors of factories could be lighter than they usually were. This was obvious, but not always practicable. With light floors, a small illumination would suffice to make the floor look bright. But in most factories the floors were constructed of wood blocks, and were dirty and greasy; and it would be interesting to learn how in some way floors could be kept lighter. Mr. Dow briefly alluded to the question of diversity-factor. He (Mr. Paterson) was surprised at the 25 per cent. mentioned. The reason that factories sometimes looked uncomfortable and unpleasant was not because the illumination was too low, but because the variation in the degree of illumination was so great. Very bright intermittent parts due to bad distribution gave a most unsatisfactory effect. Therefore, he must say that a general low degree of illumination was much better than a high average with a great diversity factor. As to the specification of standards of lighting, the more one saw of factories, the more was one convinced that it was not very necessary to have tables of illumination standards for all different classes of work; but he thought it would be quite sufficient to divide the different kinds of work into two classes, rough and fine. In the case of fabrics, however, this was a class of work which required special consideration; and he was not sure that, if they included it in fine manufacturing operations, 3·5 foot-candles would be sufficient. It certainly would not be sufficient for working with black cloths.

Regarding indirect lighting, he thought it most desirable that they should have a little more data which would enable them to know what the diversity factor was, and what was the distribution of light in different cases—data worked out to the same accuracy as in the case of direct lighting. Indirect lighting he thought an ideal system, if it could be done at the price. Regarding the minimum of 0·25 foot-candle, it was not intended that this should be measured in the darkest place. He was acquainted with the Home Office Inspectors well enough to know that they would give the greatest possible consideration to any measurements they had to make in this connection, and they could be trusted to do the work in as practical a way as possible.

Mr. A. Cunnington (L. & S. W. Railway) said he had been looking through a number of tests he had made in different goods warehouses; and he found there was no difficulty in arriving at the figure of 0·25 foot-candle as a minimum for the floor. Of course, in this he had only taken a general minimum. He had not gone into the darkest corners, but had exercised a certain amount of discretion. In the case of ordinary lighting, where there was a big row of gas-lamps down a narrow platform, he simply took the average minimum between the lamps. He found the minimum varied between 0·2 and 0·4 foot-candle. In one particular case of a large shed in an important place, there were formerly arc lamps; and the maximum was very high, and the minimum fell very low. A very wide diversity was obtained with arc lamps. This had been altered with half-watt lamps; the difference between maximum and minimum having been very much reduced. It had been suggested to him that, supposing illumination was made very uniform in a factory—supposing the illumination could be arrived at so that the illumination on the floor was really 0·25 foot-candle all over, would this not give rather a dull effect, and make the place appear inadequately lighted? He did not think that was so; for he had found a small area where the minimum illumination was 0·25 foot-candle all over—that was really the average all over—and it was not so there. He had been surprised to find how bright was the average of 0·25 foot-candle. One point mentioned by Mr. Dow was the whitening of steps; and he suggested this as a safeguard. It was; but there was also the other side, that employers would be a bit chary about. It was that, as soon as the steps had been whitened, the responsibility was accepted of keeping them white. Whitened steps soon got dirty, or the whitening was swept off. If it was proved that the steps had not been whitened when some one fell down, the responsibility would be upon the owner or occupier of the premises.

Mr. Leon Gaster also thanked Mr. Dow for the trouble he had taken in preparing the paper. It was very useful to have such an impartial view presented to them; and to have someone come along and say that the Home Office recommendations could be readily realized with both forms of modern lighting—gas and electric. As to the point Mr. Wheat raised about shadows, he (Mr. Gaster) thought that sharp shadows on floors had the one drawback that there might not be a sharp shadow where it was fancied one existed, but an actual obstruction. Shadows in factories were, in themselves, bad.

Mr. F. W. Willcox thought the ideal to be aimed at was to make artificial lighting so that they were unconscious of its presence—the same as in the case of daylight. He thought they had now arrived at a point which needed emphasis, and that was the incompleteness of merely taking foot-candles or any other physical measurement as the basis to determine illumination. They had to deal with an instrument, the eye, which was affected by physiological causes in some cases, and psychological causes in others, which made it function better under the same degree of illumination with one form of lighting than with another. The same intensity of lighting was not required with indirect lighting as was required with direct lighting, because the eye functioned more freely with an agreeable diffused light.

Mr. O. E. Grigsby pointed out that most of the data given in the report of the Departmental Committee as to existing lighting in factories were obtained with old types of lamps and old gas-jets. When they came to the new types, the conditions were all greatly improved, and values could be raised very easily.

Mrs. M. A. Cloudesley Brereton remarked that Mr. Dow had raised the question of the physiological and psychological effects of lighting. By this she was reminded of what Sir John Cockburn said at the time of the National Gas Exhibition as to the psychological effect of light. He said that light had an important stimulus not only on the body but on the mind; and when he turned on his lamps in his study, he felt the effect of their power upon him as though it were sunshine. In her experience, where factories had modern conditions of lighting, the employees were, in effect, working in sunshine; and where there was good light, the girls enjoyed better health. This was a fact that should be brought home to employers. Taking it generally that good lighting had a good physiological and psychological effect, this in itself should be an encouragement to backward factory managers in complying with the recommendations of the Home Office Committee. Besides this, increased output was something of which they had to think—even more in future than in the past. Yet another point which should be brought before factory managements was the very close co-operation there should be between builders, decorators, and illuminating engineers.

One or two other speakers followed with a few remarks; and Mr. Dow reserved his reply to the discussion, which will be communicated in writing.

COKE-OVEN MANAGERS' ASSOCIATION.

First Annual Dinner.

The First Annual Dinner of the Coke-Oven Managers' Association took place on Saturday at the Grand Hotel, Sheffield—the President (Mr. George Chrisp) presiding over a large company. Among those supporting the President at the head of the table were Professor W. A. Bone, F.R.S. (of the Imperial College of Science and Technology), Lieut. R. H. Montgomery (of the Ministry of Munitions), and Mr. George Blake Walker (of the Institution of Civil Engineers and the Institution of Mechanical Engineers).

After a most enjoyable repast, the Loyal Toast was duly honoured.

Mr. C. P. Finn, B.Sc., in proposing "The Army and Navy," remarked that the first dinner of the Coke-Oven Managers' Association found the nation confronted with a menace abroad—and perhaps at home—to the power of the British Empire. If it were not for the Army and Navy they would not be there that evening.

Lieut. R. H. Montgomery, in responding to the toast, said it was with a sense of very real humility that he rose to thank the proposer and the assembly. In answering for the two Services, in regard to the point of the proposer that they would not have been there that evening but for the Army and Navy, he might affirm that the converse was equally true. If it were not for the coking industry and its bye-product of to-day, the Army and Navy would be useless. He felt that he was addressing a company who represented certainly the most important portion of the whole of the industrial warfare. Without them and their product, all the efforts of the Army and Navy would be utterly futile. He did not know whether the fact had ever collectively occurred to his hearers, but it had been impressed upon him very strongly that what they did in this war was practically entirely dependent upon the efforts of the members of their Association. If there was anyone in the room who had not yet realized this fact, he hoped he would bear it in mind in future. There had been numerous discussions—the question of slack for coke-ovens, &c.—and he had been told by various colliery proprietors "Oh, all our slack goes to the munition works." Attention must be concentrated for the present upon every possible means of producing high explosives. What was the use of many guns without explosives? Though this was a Coke-Oven Managers' Association—and they naturally associated coke with coal and commerce—they must look upon the mere production of coke as being a bye-product, during the period of the war at any rate. Coke was important, of course; but he hoped those in charge of coke-ovens would bear in mind that when they were dealing with their ovens the product most to be looked after at present was the benzol—that they run their ovens more with benzol in view than coke. The commercial people and others of that ilk must go by the board just for the present, and the whole of the energy be put into the question of benzol—not only for the use of this country, but for the use of our allies. He was giving away no Government secrets when he said that this country was sending thousands of tons of benzol to the allies. He, himself, of course, had benzol on the brain, and wanted everybody to have it on the brain.

The President, in introducing Professor Bone, said introduction was scarcely necessary, as he was well known among them, and his reputation was deservedly high because of his contributions to, and his work in, science. He was concerned in fuel economy, and his work thereby lay very close to their own. The Professor's chief popularity with coke-oven men lay in his very daring suggestion to the Government that they should restrict the output of coke from ovens and hasten the production of bye-product in the interests of the nation in the present crisis. He need scarcely say how highly the Association was honoured by the presence of Professor Bone that evening.

Professor Bone said he considered it was an unmerited honour to be called upon to propose the toast of the evening. He felt, after the very "bully" speech of their distinguished friend, the representative of the Ministry of Munitions, that it was almost superfluous for himself to make any speech at all in proposing the toast. He was, of course, not a coke-oven manager. His work lay in a direction which bore upon a good many of the problems connected with the technology of carbonization, and he could, to some extent, appreciate some of the aspects of the problems they were called upon to deal with from a technical point of view day by day. But on an occasion of this sort, and in a crisis like the present, it was not so much the technical details of the question as the broad principles of the matter that they might consider. They were all to be congratulated upon the fact that the Association was being inaugurated at this particular time. It is very important that a new industry—and it was practically new—should form an organization for the discussion not only of its own technical problems, but also of its broad economic and commercial interests. Most other branches of industry had already—and many had been in existence for long periods—associations of this kind. He thought the future coke-oven managers would look back with pride as well as with interest upon the fact that their forelders in the industry started the Association in the year 1915, because, as his friend Lieut. Montgomery had reminded them, the industry had played, and would play, a very great part in what they all hoped would be a favourable decision of the great war in respect not only of their own Empire, but in the interests of the civilization and liberty of the world as a whole. He ventured to think that the importance of the Association, great as it was at the present moment, would be even greater in the period which would come about after the war. The bye-product coking industry was, practically speaking, imported from the Continent; and, to give the enemy his due, he thought they must all confess they owed a great deal in this matter to German enterprise. He did not mean to say German originality, because he did not think the Germans could claim historically the origin of some of the great ideas in the industry; but they had seen the economic importance of the supersession of the old wasteful beehive oven, and had developed some of the existing systems to a high pitch of efficiency. Having done this, in their own commercial interest, they had come here and, together with organization which originated in Belgium, did much to start the industry in England. Where, asked the speaker, should we have been but for German enterprise in this particular? We had now to consider whether we could not stand on our own feet in this matter. They would not think any the worse of the German because he had convinced them of the importance of the industry; but he hoped that the future chapters of it would be retained in the future chapters of Great Britain, and that we should be able to say we never afterwards had to look to German enterprise for our own industry. If this were so, the victories of peace would be greater than the victories of war. In the future, world power would lie with that race which would combine character with high scientific attainments, and the power to apply these principles to the common things of life, which some scientific people, he was greatly afraid, were so much inclined to despise. He was convinced that the future in world power and influence would lie with the race which combined a high moral standard of character—and he believed we could really claim, with all our faults, that the standard of commercial and technical integrity was higher in this country than in any other country in the world—with the planting and development of the highest technical efficiency in the application of truly scientific principles. The future depended on gentlemen like those before him. It depended for the present on the prowess of the Army and Navy; but the Army and Navy could never do the other thing for them. It depended upon them all. And there was one thing which he believed would come out more after this struggle was over. He was not in any way suggesting that the patriotism of the Army and Navy was inferior to any other form—but he believed that the highest form of patriotism which the citizens of a nation could show was that every man would be prepared to add to the general stock of knowledge and experience that which he knew best for the good of the most, and would be prepared to sacrifice, to some extent, his own interests in so doing. The keeping back, for the selfish interests of the individual, of what he was pleased to think was some special secret, was the lowest form of conduct of which a man could be guilty. He thought that in these aims, in the past in England, we had somehow missed the mark. They were always hearing of people who were diffident of disclosing experience and knowledge for fear they should give away a secret. There were times, perhaps, if a man had some special knowledge, when by not prematurely disclosing it he could achieve a better outcome; but if he was firmly patriotic, there must come a time when he must bring that knowledge to the common stock. He hoped the Association would become a common solvent to receive the experience and knowledge which each of the members would gain, that it would attract knowledge and experience from outside by its discussions, and would become a great receiving house for the dissemination of knowledge to the interests of the whole industry. He, therefore, felt it a great honour to propose the prosperity of this infant Institution, which he firmly believed had a great future, and would have considerable influence upon the industries of the country as a whole.

The President, in responding, said he thought they could claim with certainty that the "baby" was going along very well, and was now able to sit up for nourishment. He sincerely thanked Professor Bone for his kind remarks about the Association. Many of the points advocated by the Professor were the very points the Association had under serious consideration, and they would welcome with great joy collaboration from the scientific institutions. They thought better opportunities for higher education should be afforded for the coke-oven manager of the future. They did not suggest that the University man would necessarily make the best coke-oven manager. The coke-oven manager was a curious blend of a chemist, an engineer, a bookkeeper, and a navvy ganger; and he did not know whether a University man would provide all these qualifications. With regard to the dinner, many people looked with some disfavour upon such social functions at the present time. He would venture to remind such people that a coke-oven manager's life was a strenuous one. He worked pretty well 24 hours a day, 365 days a year. Julius Cæsar or somebody had thrown in an extra day this year; and so the coke-oven managers were having their dinner. He would like to set forth two of the primary objects of the Association. First and foremost, the chief object was the advancement of the coke-oven industry in all or any of its branches. No matter how this was to be done, it had to go on. It was up to them all and their successors to make the thing an unqualified success, and keep the Germans out. They had to stand by another and to help each other, and to make failure success and inefficiency efficiency. If they could do this by combination and interchange of ideas and opening-out channels for the letting-out of those sources of information that they knew of, they would be doing a great good. Reverting to the status of the coke-oven manager, they wished to see this improved. They believed the time had come when they should have official recognition from the Government. The Association itself had already proved a most conspicuous success; and a great deal of the credit was due undoubtedly to the untiring work of their Hon. Secretary (Mr. Price).

Mr. G. Stanley Cooper, in proposing "Kindred Societies," said the predominant thought in connection with this toast at the inaugural social function of the Society was one of comparison—comparison in the sense of what the Association was, and what it might be in relation to other professional institutions of a similar type. For a considerable time a number of them had been very eager to have a society of their own. They had had kind invitations by the Gas Engineers and Mining Engineers and other societies to join them; but none of these societies quite catered for the coke-oven industry. It was up to themselves to make or mar the new Association of their own. They were fortunate in having at the head of the industry a man of the academic calibre of Professor Bone. They were not, indeed, such a blackleg lot as some people seemed to think. They might have a touch of the navvy ganger about them, but there were times when they could throw it off. They were beginning to learn the scientific side of the bye-product industry, and they hoped to get men of scientific attainment to throw themselves in with them and give their help. They had in Mr. Blake Walker a representative of the early days of bye-product coking; and they were pleased to see him among them. What they wanted to do was to try and follow somewhat on the lines of other professional associations, which had their traditions to look back upon, while the coking industry had not; and they must look to the others for guidance.

Mr. George Blake Walker, responding to the toast, said "science is one, but it is by no means indivisible"—in fact, it was infinitely divisible and sub-divisible. The Association had inaugurated a sub-division of science—one which was intimately connected with a whole ring of divisions of science and subdivisions of science. There could be no doubt whatever that they were in the same position with regard to a number of other societies which were either located in their industrial neighbourhood or which were in touch with them through the Press. He would remind them that matter existed in three conditions—the solid, the liquid, and the gaseous. They had had an admirable exposition of solid advice from the previous speakers; they had had a liquid stream of fluent eloquence; and it only remained to add that volatile influence, the gas in which they were all so interested. He would like to feel that with the increasing temperature of the room the carbonization of the solid matter which had been already put before them would leave in the air some of that light effluent which contained the bye-product in the subject in which they were all so greatly concerned. Deserting the metaphorical oratory, Mr. Walker said bluntly that, so far as their industry was concerned at the present time, the trade of the country might "go to the devil;" but whatever else they had or had not, they must produce more toluol. By hook or by crook, whatever else might have to be left undone, they were to be persuaded into producing every cubic foot of gas and every ounce they could of material for high explosives. In proportion as they increased their high explosives, so much sooner would they bring to a conclusion this terrible war. In this country we were fortunately unmolested in the pursuit of our industries. France, Belgium, and Russia were not so unmolested; and so the great weight of the production of these things rested upon our shoulders. He felt sure that the right hand of fellowship would be held out by every scientific society to whom the coke-oven managers might apply for help and advice. With regard to the making common of ideas and discoveries, there was a practical difficulty which he dared say a great many of them felt, and especially some of the younger members—that our scientific equipment was very far from what one would like it to be in dealing with complex commercial questions. There were two things which anyone with an idea in his mind was uncertain about. First, had the idea occurred to anybody else and been already tried and found a failure? In the next place, the idea presented itself to an untrained mind in a shape that would perhaps not be likely to produce practical results. Therefore, it was desirable that such half-formed ideas should be referred to some body of experts who were familiar with these questions; and he would suggest that the Council of the Association might arrange, through the medium of some of the professors and specialists of the Universities or through the Societies of Engineers and Metallurgists, that there might be a Committee of reference, to whom, at suitable times and opportunities, anyone who had the germ of a new idea might go.

The speeches were pleasantly interspersed with musical and recitative contributions.

The December issue of "A Thousand-and-One Uses for Gas" (published by the British Commercial Gas Association) was a wholesale drapers' number; and in the current issue there is matter of special interest to retail drapers. The lighting and heating of shops is a subject of wide usefulness. Good lighting and good heating of interiors are of great importance, both from the customers' and the employees' point of view, even in wartime; and this means that their careful study will repay the employer. Time and money so spent will be well spent.

SWISS TESTS OF GAS-FIRES.

By Dr. E. Ott, of Zürich.

We conclude to-day [see *ante*, p. 91] a translation of the article contributed Dr. E. Ott to the "Journal für Gasbeleuchtung" of Nov. 6 and 13, giving an account of investigations carried out by him in the laboratory at the Schlieren works of the Zürich gas undertaking, on the efficiency of different types of gas-fires.

Types of Gas-Stove Investigated.

Five types of gas-stove were investigated, in some cases in two or more different sets of conditions. The types were: (1) Convection stove shown in fig. 4; (2) reflector stove shown in fig. 5; (3) gas-radiator shown in fig. 6; (4) radiation fire shown in fig. 7; and (5) the stove shown in fig. 8, which can be used either as a radiation fire or as a convection stove, according as the front doors are open or closed. The last type was tested both with the doors open and closed.

Methods of Testing.

In general the stoves were tested in the following manner: They were lighted and kept burning for one hour at the full normal rate of consumption, and some observations made in this condition. Temperature measurements and carbonic acid determinations on the flue gases were made both at the flue exit from the stove and at the point where the flue-pipe passed out of the room. In most cases these observations were repeated with the draught in the flue exit from the stove regulated to 0·004 inch of water and to 0·012 inch of water. Those stoves which were provided with an anti-down-draught device—to prevent the flames being extinguished or otherwise disturbed before the flue draught was established or by subsequent down-draught—were tested with this device first out of action and then in action. After the first hour, the stove was turned down to the reduced rate of consumption at which it was intended to work after the initial warming of the room had been done, and was kept at this reduced rate for two or three hours. The observations named above were then repeated on the stove at the reduced rate of consumption, with the flue draught at 0·004 inch of water.

Observations were made of the radiation with the stove at the full consumption and with the flue draught of 0·004 inch of water. As a matter of fact, it was not considered necessary to determine also the radiation at the reduced rate of consumption.

Observations to determine the distribution of temperature in the room were made on days when there was very little wind and with a moderate outside temperature. Readings were made on the eighteen thermometers in the positions shown by the numbers in fig. 1 [*ante*, p. 89]. Series of readings were taken both after one hour's use of the fire at full consumption, then after a further two hours' use at the reduced consumption, and again after a subsequent hour's use at the reduced consumption. The gas was then turned out and readings made at intervals of an hour, in order to observe the rate of cooling of different parts of the room.

The results of the observations indicated above are given in the original paper, from which the more important of them have been abstracted in the table below.

Comments on the Convection Stove—Type I. (Fig. 4).

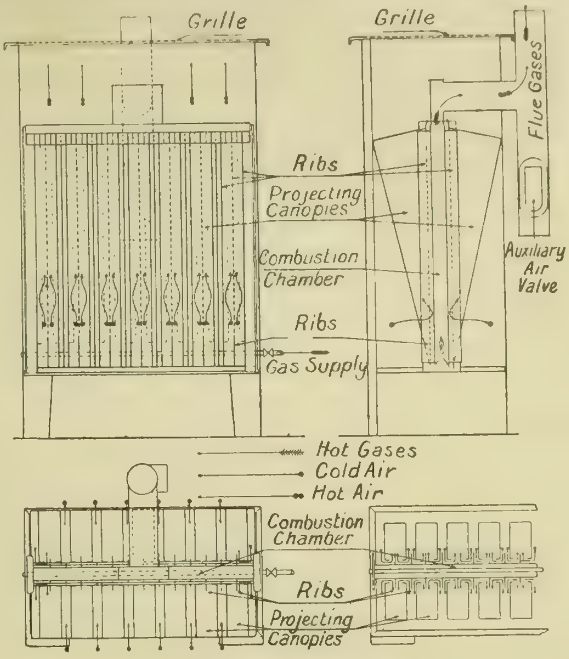


Fig. 4.—Convection Stove.

It was noteworthy that in this, as with most of the stoves, the temperature of the flue gases increased with the draught, though

Results of Testings of Five Types of Gas-Stoves, with Flue Draught at Stove Outlet of 0·004 *Inch of Water.*

No anti-back-draught device in action.——All rates of consumption and calorific values refer to cubic feet at 60° Fahr. 30 inches and saturated.——The net calorific value of the gas ranged from 487 to 519 B.Th.U. per cubic foot.——One volume of the gas produced on combustion from 0·480 to 0·495 volume of carbonic acid.

	I.	II.	III.	IV.	V.	
Type of Stove.	Convection Stove.	Reflector Stove.	Radiator.	Radiation Fire.	Radiation or Convection Fire.	
					Used as Radiation Fire.	Used as Convection Stove.
Test at full consumption:—						
Rate, cubic feet per hour	26·7	26·6	27·1	27·9	27·9	27·0
B.Th.U. per hour in gas (net calorific power multiplied by rate)	13,880	13,170	14,078	14,047	14,166	13,650
Carbonic acid in hot humid flue gases, per cent.	6·5	4·8	6 15	4·9	4·4	4·2
Temperature of gases at flue vent, degrees Fahr.	280	415	300	340	426	460
,, ,, air in middle of room ,, ,,	84	70	81	75	75	72
Efficiency (utilized percentage of B.Th.U. (net) employed)	94·6	87 0	93·7	90·3	85·7	83·5
Continuation of test; consumption being reduced:—						
Rate, cubic feet per hour	16·3	14·2	13·9	15·4	13·4	13·0
B.Th.U. per hour in gas (net calorific power multiplied by rate)	8,384	7,023	7,198	7,769	6,821	6,555
Carbonic acid in hot humid flue gases, per cent.	4·0	3·1	3·5	2·85	3·1	2·45
Temperature of gases at flue vent, degrees Fahr.	232	248	250	275	376	360
,, ,, air in middle of room ,, ,,	81	66	79	73	72	68
Efficiency (utilized percentage of B Th.U. (net) employed)	93·3	89·4	91·3	87·3	82·4	78·7
Tests at full consumption:—						
Radiation measured per cent. of energy (B.Th.U. net) employed	1·48	8·61	19 68	29·14	19·19	3·65
Rise shown by thermometers in different parts of room (see fig. 1) in one hour from lighting of fire, at rate of consumption stated.						
Cubic feet per hour	26·9	27 9	27·4	27·7	27·9	27·7
Thermometer No. 1 (lampblacked) degrees Fahr.	2·9	4·1	8·3	10·3	9·0	3·8
,, ,, 2 (clear) ,, ,,	14·9	12·4	14 2	13·5	13·0	13·1
,, ,, 3 ,, ,, ,,	2·7	3·6	6·1	8·6	7·0	3·2
,, ,, 4 (lampblacked) ,, ,,	2·7	4·1	9·0	13·0	10·1	3·4
,, ,, 5 (clear) ,, ,,	15·3	12·8	13·3	13·9	14·0	13·7
,, ,, 6 ,, ,, ,,	2·3	3·1	6·1	8·5	6·8	10·8
,, ,, 7 (lampblacked) ,, ,,	2·9	6·8	9·2	16·7	13·9	4·1
,, ,, 8 (clear) ,, ,,	15·7	13·0	14 0	15·1	15·1	13·7
,, ,, 9 ,, ,, ,,	2·5	5·2	6·1	10·3	7·2	2·7
,, ,, 10 ,, ,, ,,	2·2	2·3	3·1	4·3	3·6	2·2
,, ,, 11 ,, ,, ,,	15·3	11·9	11·5	11·9	11·5	12·8
,, ,, 12 (lampblacked) ,, ,,	2·2	2·3	3·6	4·7	4·1	2·2
,, ,, 13 (clear) ,, ,,	2 0	2·2	3·1	4·1	3·6	2·0
,, ,, 14 ,, ,, ,,	15·5	11·9	11·7	12·4	11·7	12·8
,, ,, 15 (lampblacked) ,, ,,	2·2	2·3	3·8	5·2	3·6	2·0
,, ,, 16 ,, ,, ,,	2·0	2·0	3·1	4·5	3 4	2·0
,, ,, 17 (clear) ,, ,,	14·9	12·1	11·2	12·2	11·7	12·8
,, ,, 18 ,, ,, ,,	2·2	2·2	2·9	4·0	3·1	2·0

the reverse might be expected on account of more air being drawn through the flue. No escape of flue gas was found with this stove. The use of the anti-down-draught flap had very little effect on the efficiency; the reduced proportion of carbonic acid in the flue gases being balanced by a lower efflux temperature. The ventilating action is increased by the use of this device and also by increased flue draught. The differences in efficiency of this stove in different conditions are comparatively little. The total radiation was very small, being greatest at the angles 1 and 5 (see fig. 3, *ante*, p. 90), and lowest at angle 3.

This stove, being of light construction, attained its maximum heat in three-quarters of an hour; and with the gas turned off it cooled down in about the same time. The burner orifices were sufficiently close together for the flames to light one from the other. They were luminous flames, which could be seen, with difficulty only, through a lateral window. There was no smell of gas in the room when the flames were extinguished and the gas left turned on. The flue gases were free from carbon monoxide. Stopping the flue draught caused the flames, when fully turned on, to flicker; but this was easily cured by replacing the flap-valve by a simple opening. The hot surfaces of the stove, being nearly vertical, did not collect dust; and the temperature in the upper part of the stove did not exceed 300° Fahr. at full consumption or 410° Fahr. at the reduced consumption. The outer parts of the stove remained almost cold; hence the low radiation of this stove. It was built of aluminium (hence the rapid exchange of heat) and represented a very good example indeed of the type of pure convection stove.

Comments on the Reflector Stove—Type II. (Fig. 5).

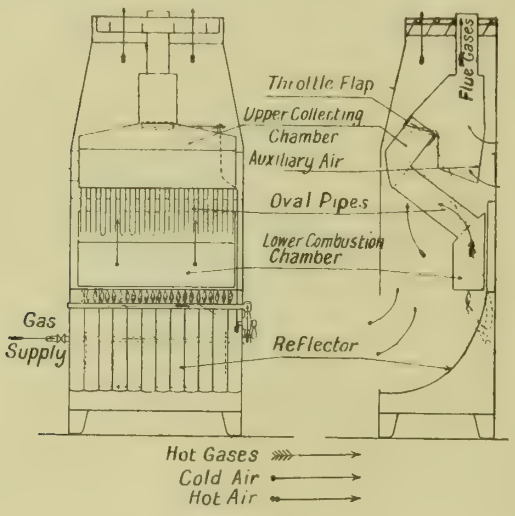


Fig. 5.—Reflector Stove.

With this stove there was escape of flue gas, which was reduced when the draught was increased; and for this reason, as well as the reasons given for the convection type of stove, the temperature of the escaping flue gases showed a notable increase as the draught was increased. The opening of the anti-down-draught device, which was an opening directly above the hot register, also caused an increase in the temperature of the flue gases. Neither the use of this device, nor reduction of the rate of consumption, nor small increase in the flue draught, had any appreciable effect on the efficiency—partly owing to the small cross-section of the flue exit causing a throttling of the flue gases. The radiation was fairly uniformly distributed; being highest at angle 2 and lowest at angle 6 (see fig. 3).

This stove, also, owing to its light construction, attained its full heat in about forty minutes after lighting; and when the gas was turned out cooled down again in less than an hour. The action of the reflector caused an increase in the radiation as compared with the convection type of stove, and, correspondingly, there was a lower temperature of the air at the breathing level. Both with the flue draught of 0·004 and 0·012 inch of water there was some escape of flue gases into the room, and a smell of gas when the flames were extinguished but the gas left turned on. This fault could be overcome by a higher position of the burners and a widening of the flue exit. The flue gases were free from carbon monoxide. The inclined oval heating tubes attained a temperature exceeding 400° Fahr. at full consumption, and exceeding 210° Fahr. at the reduced consumption; the temperature of the escaping air being in the former case 230° Fahr. All parts of the stove were readily accessible; and, though it was of light construction, it was sufficiently strong. It was a typical specimen of the reflector stove.

Comments on the Radiator—Type III. (Fig. 6).

With this type also neither the use of the anti-down-draught device, nor increase in the flue draught, nor reduction in the rate of consumption had any considerable effect upon the efficiency. The radiation was tolerably high, owing to the flames being luminous, to a reflector being used, and to the dull metal parts being at a high temperature. The radiation was fairly uniformly distributed—greatest at angles 1, 2, and 3, and lowest at angle 6 (see fig. 3). Owing to its heavy construction, the radiator took an hour to heat up to its full temperature, and more than an hour to cool down again after the gas was turned off. The effect of radiation on the thermometers was quite marked; and the temperature of the air at the breathing level was correspondingly lower. The burners, being batswing or slit burners, could be turned down as desired.

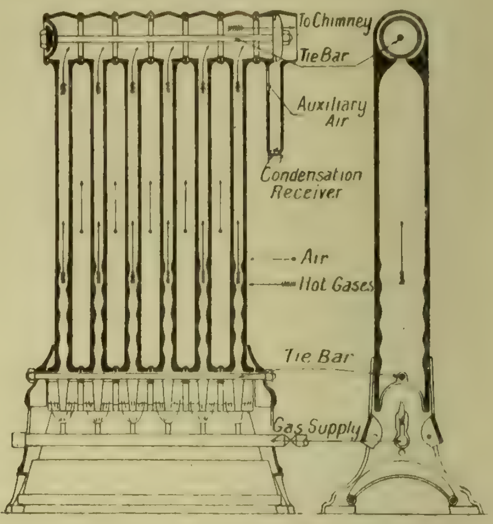


Fig. 6.—Radiator Stove.

With the anti-down-draught device open, no appreciable escape of flue gases took place. Interruption of the flue draught when the burners were turned full on caused a tendency to smoke, and to the formation of carbonic oxide; but with the flue fully open the flue gases were free from the latter. At full consumption the temperature of the lower communication tube much exceeded 570° Fahr.; that of the upper communication tube was about 210° Fahr. At the reduced consumption the corresponding temperatures were about 446° and 185° Fahr. The temperature of the air between the columns of the radiator when at full consumption was about 194° Fahr., and the air directly above the radiator about 176° Fahr. The hot surfaces, being vertical and easily accessible, could be readily kept clean. The radiator was solidly constructed of cast iron, and intended for office use, &c. In virtue of its good radiation and convection results, it constituted a good intermediate type between the radiation and the convection stoves.

Comments on the Radiation Fire—Type IV. (Fig. 7).

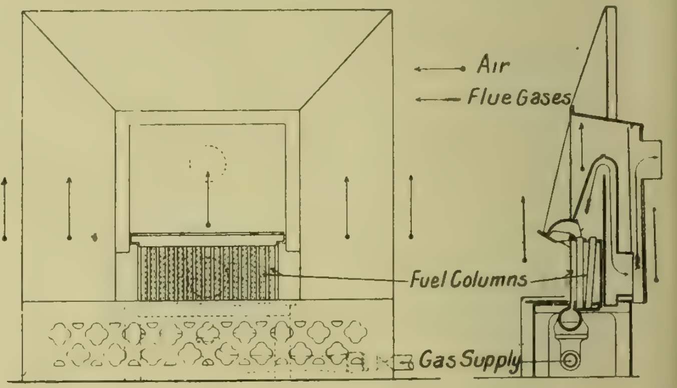


Fig. 7.—Radiation Fire.

This fire had no anti-down-draught device. Reduction of the rate of consumption greatly affected its efficiency owing to the bad transmission of heat through the heavily constructed stove. The difference in efficiency at the flue outlet and at the outlet of the flue pipe from the room was very considerable with this type, owing to the high temperature of the flue gases at the flue exit from the fire. The radiation, amounting to 29·14 per cent. of the heat applied, was highest at angles 3 and 4, and lowest at angle 1 (see fig. 3). The upright fuel columns gave the highest radiation in a horizontal direction. This fire also, on account of its heavy construction, needed about an hour to attain its full temperature, and about an hour to cool again after the gas was turned off. The effect of the radiant heat on the thermometers was naturally large. The burners being of the atmospheric type, the rate of gas consumption could not be greatly reduced without risk of the flames striking-back. There was no device for regulating the air supply to the burners. The flames lit one from the other. Flue gas escaped into the room, especially before the fire had got fully hot, both at 0·004 and 0·012 inch draught in the flue, as shown by the fact that the proportion of carbonic acid was 15 parts per 10,000 in the air of the room, and 100 parts per 10,000 immediately in front of the fire, at the full rate of consumption. With the flue unobstructed there was no carbonic oxide in the flue gases. Down-draught in the chimney did not extinguish or affect the flames to any appreciable extent. Some parts of the stove were very hot; the air above the centre of the back-plate was above 480° Fahr.

at the full rate of consumption; and at the reduced rate, above 300° Fahr. The surfaces of the stove, being nearly vertical, collected little dust. The stove was of solid construction, and the fuel columns were not brittle. It was typical of a true radiation gas-fire.

Comments on the Radiation or Convection Stove—Type V. (Fig. 8).

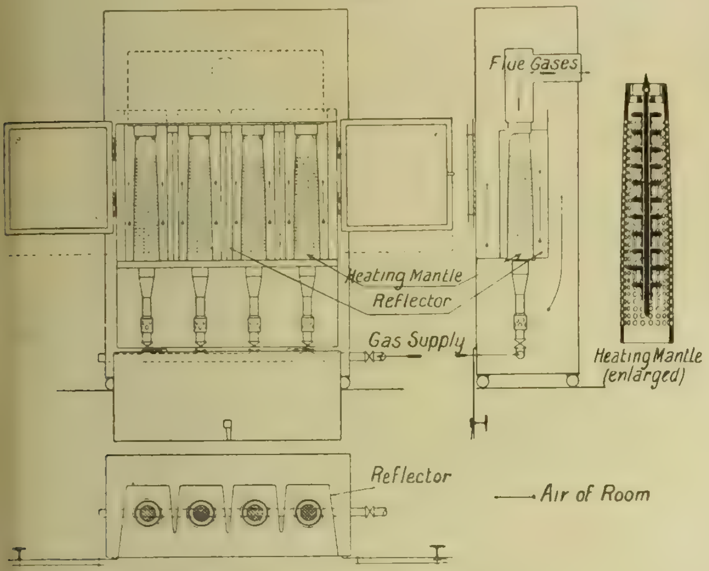


Fig. 8.—Radiation or Convection Stove.

This stove was provided with doors or hinged flaps to admit of it being used either as a radiation or convection stove. These doors, for the purposes of these investigations, were extended downwards, as shown by the dotted lines. The investigations on this fire were made both with the doors open, in which condition radiation had full play, and with the doors closed, which converted it into a convection stove. The investigations with this type were made with a view to following the distribution of temperature with strong and with reduced radiation with the same stove; and the results are not in some respects comparable with the figures obtained for the other types. Owing to considerable escape of flue gas, the efficiency also could be only determined approximately; and in this respect also the figures are not comparable with those for the other types. There was no anti-down-draught device.

With the doors open, the temperature of the flue gases at the flue vent was very high; and hence the efficiency appears low. Reduction of the rate of consumption greatly affected efficiency. The radiation, amounting in all to 19·19 per cent., was greatest at angles 3 and 4, and lowest at angle 1 (see fig. 3). The stove attained its full heat in about fifty minutes, and after the gas had been turned off took about the same time to cool down. The four burners, being wide apart, did not light one from the other. The burners were of the Mèker type, and could therefore be turned down without striking-back. They were provided with air regulators. There was considerable escape of the flue gas into the room; the proportion of carbonic acid in the air in the neighbourhood of the fuel columns being 100 volumes per 10,000, even at the reduced consumption, and in the air of the room 25 volumes per 10,000 at full consumption, and 15 volumes per 10,000 at the reduced consumption. The flue vent ought therefore to be greatly improved. Carbonic oxide was not detected, and the flame burned steadily, even when the flue draught was checked. The temperature of the metal at the flue exit was nearly 570° Fahr. at full consumption, and 390° Fahr. at the reduced consumption.

With the doors shut the efficiency was lower than with them open. The total radiation was reduced to 3·65 per cent.—being highest at angle 1 and lowest at angle 4. The bad efficiency appears to be due partly to increased flue-gas temperatures, owing to less cooling by air, and partly to a lower proportion of air in the flue gases, which was probably caused by the escape of carbonic acid into the room being greater than when the doors were open. The stove was pretty and light, though of sufficiently heavy construction. The escape of flue gases into the room could probably be avoided by shortening the columns of fuel and enlarging the flue vents. The stove might be converted into a good combination of the radiation and convection stove. A later type of the stove, however, gave substantially the same results.

Conclusion.

It may be pointed out that the figures for the rate of cooling of the rooms showed clearly that rise of temperature in which radiation has played a considerable part falls away much more slowly after the gas is turned off than corresponding rises of temperature produced chiefly by convection. This is due not merely to the heavier construction of the radiation fires, but to the higher floor and wall temperatures, and is specially noticeable in the experiments on the fifth type of stove, with which the temperatures produced when it was used as a radiation fire fell off much more slowly than when it was used as a convection stove.

The more a stove heats by radiation the more rapidly ensues the feeling of warmth from it, and the more slowly does the temperature fall after it is turned out. Though good radiation produces considerably higher floor temperatures in the neighbourhood of the fire than convection, there is no considerable reduction in the temperature at the breathing level. Moreover, a radiation fire with a smaller efficiency heats more rationally than a convection stove with a higher efficiency, owing to the more favourable distribution of temperature. With a very large fire, the radiation in its vicinity becomes troublesome, and it therefore follows that the scope of the two chief types may be stated as follows: The radiation fire is more suitable for small rooms, or rooms which have to be heated only occasionally, while the convection stove is more suitable for large rooms or for continuous heating. There naturally will be many transitions; and taste plays a large part in the selection.

The efficiency of the fires, with the exception of Type V., both at full and reduced consumption, with the flue draught of 0·004 inch, generally exceeded 90 per cent. at the flue-vent, and always exceeded 90 per cent. at the exit of the flue-pipe from the room. Any endeavours to utilize the heat of the flue-pipe to secure this higher efficiency are not of much value, as often only very short flue pipes can be used. Further increase of efficiency would involve risk of condensation of water from the flue gases, and special arrangements would have to be made for removing the condensed water. The anti-down-draught devices used with certain types of stove did not reduce the efficiency to any considerable extent, while they increased the ventilation.

Some attention should be given to the better removal of the flue gases in the radiation type of fire, although the proportion of carbonic acid found in the air never reached a dangerous figure. Even in experiments without connection to a chimney, the proportion of carbonic acid in the middle of the room never exceeded 40 parts per 10,000 during the first hour at full consumption, or 30 parts per 10,000 during subsequent heating at reduced consumption; whereas even 100 volumes of carbonic acid per 10,000 are not injurious to health. One hour after the gas had been turned off the proportion of carbonic acid had again fallen to 10 volumes per 10,000. These observations support the oft-repeated contention that a certain equilibrium in the composition of the air becomes established in closed rooms owing to the renewal of the air through walls and cracks. No stove, even with the flue cut off, produced carbonic oxide in such a proportion that it rendered the air of the room injurious to health.

Finally, the satisfactory behaviour of a well-constructed gas-stove is also largely dependent on its being chosen of a suitable size for the size of the room and the temperature required, as well as on its being properly fitted and looked after.

INDUSTRIAL GAS: ITS SERVICES TO THE NATION.

Mr. H. M. Thornton's Lecture at Derby.

In last week's issue—pp. 81-5—we gave the principal portions of the interesting lecture that Mr. H. M. Thornton, the Managing Director of the Richmond Gas Stove and Meter Company, delivered the previous night at a meeting of the Derby Society of Engineers. Mr. Thornton concluded his remarks with these words: I do not claim to have shown all the ways in which gas has served us in war time—the illustrations given are doubtless only representative of a greater number that will become known when the time comes to write the history of this country's remarkable effort to cope with the wholly sudden and absolutely unexpected demand for munitions of war. I hope, however, I have said sufficient to explain the gratification which is felt by the gas industry at large at the prominence it has been able to attain in the hour of the nation's need.

Mr. J. Ferguson Bell, M.Inst.C.E., the Engineer and Manager of the Derby Gas Company (who presided), in introducing the lecturer, said that one outcome of the war was that, in engineering processes, old methods had been compelled to give place to new, and that engineers now found it necessary to look at matters from a new standpoint. The tendency among manufacturers to continue without changing their methods, and the reluctance to adopt new processes, had allowed Germany to take the lead in far too many directions; but the eyes of Englishmen were now opened, and one result of the war would undoubtedly be a renaissance of British industry. The adoption of new processes not only meant reduction in costs, and greater variety in output, but an extension of markets which would doubtless be found in the near future. The lecturer would, he said, give an account of some of the new methods which had been adopted for "heat-treatment" processes, and indicate the extent to which gaseous fuel was now utilized in this country. The Richmond Gas Stove and Meter Company, of which Mr. Thornton was the Managing Director, had paid special attention to the application of gas to various industries. As had been pointed out upon several previous occasions, the present methods of using coal entailed great waste; and this waste in turn involved the waste of many of the bye-products of coal of which England now stood in great need. Both picric acid and trinitrotoluene—supplies of which largely depended on coal distillation—were essential commodities in this time of war; and it was of the greatest importance that coal for industrial purposes should be used in such a manner as would ensure the largest output of these products. The lecturer would show how these products could be made available for national use, and also how the manufacturer himself would benefit by the adoption of gaseous fuel in his industry. In conclusion, Mr. Bell heartily welcomed Mr. Thornton, and mentioned the previous lectures he had delivered, with the object of bringing before the manufacturers of the country the importance of gas as an industrial fuel.

The lecture, which was fully illustrated by about sixty lantern slides, aroused much interest. Several members took part in an informal discussion which followed; and, after Mr. Thornton had answered the various questions put to him, the meeting concluded with a hearty vote of thanks to the lecturer.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Ehrich and Graetz Lamps for High Pressures.

Sir,—As a matter of interest to gas engineers and gas users who may have observed the publication of the specifications of British patent applications No. 16,132 of 1914 and No. 23,174 of 1914, of Messrs. Ehrich and Graetz, of Berlin, purporting to refer to incandescent gas-lamps such as are covered by our prior patent, No. 1348 of 1912, we think it desirable, having regard to our own patents, to point out that the publication of the specifications is not to be regarded as an indication that the applications in question will mature into letters patent.

As it happens, opposition to both applications has been entered by us with a view ultimately to stopping the grant of letters patent, although in accordance with the procedure to be followed under Rules 2 and 3 of the "Patents, Designs, and Trade Marks (Temporary) Rules, 1914," all further proceedings in the matter of the oppositions will be suspended until the end of the war.

In any event, it is not to be expected that lamps constructed as described in the specifications of the opposed applications will be put on the market even after the war, if we are correct in believing, as our Counsel advise us, that the constructions in question are dominated by our patents.

James Keith and Blackman Co., Limited,
per G. Keith, Assistant Managing Director.

27, Farringdon Avenue, E.C., Jan. 14, 1916.

Trade Teachings in School Questions.

Sir,—My attention has been called to the paragraph with the above heading in your issue of Jan. 11, taking exception to a question of arithmetic set for the students in one of our branches, respecting the comparative cost of gas lighting and electricity as lighting mediums.

I should like to point out that this question was not devised by the College, but is incorporated in the College "Text-Book on Arithmetic," as being a question set by the Civil Service Examiners at an open competitive examination for female sorter candidates.

Ernest G. V. Clark, Vice-Principal of Clark's College.

Chancery Lane, W.C., Jan. 13, 1916.

Increased Toluol Production.

Sir,—Under the above heading, in your issue of Dec. 21, Mr. B. Dunglinson deals with the "Effect of Liming Coal" and "Experiments on the Yield of Benzene and Homologues."

If 2 per cent. of finely-divided limestone is intimately mixed with coal before carbonizing, and the resultant coke is quenched out of contact with air, no particles of lime will be visible. If, however, the incandescent coke is allowed air-contact, sufficient to burn the surface carbon, fine pieces of shale or lime will show. This mottled appearance has ever been an intermittent source of trouble on many coke-oven plants, and is always due to ineffective quenching.

It is suggested by Mr. Dunglinson to: (1) Well moisten the coal with spent ammoniacal liquor; (2) carbonize at a low temperature—making 7000 to 8000 cubic feet of gas per ton of coal. Against any such method, there are the following objections: (1) Moisture reduces the temperature of the retort and prevents the formation of aromatics until evaporation is practically finished. In consequence, one of Mr. Dunglinson's experimental conclusions must be inaccurate. (2) To carbonize for a yield of 8000 cubic feet of gas per ton of coal would seriously affect economical production: (*a*) The initial coal cost would increase 50 per cent.; (*b*) the working cost would be increased; (*c*) works now producing to their capacity would have to make extensions equal to half their present plant; (*d*) the scheme could not be profit-bearing.

It is unfortunate that Mr. Dunglinson does not give in his letter last Tuesday the actual yields of bye-products recovered or recoverable during the limestone experiments which he quotes as being made at coke-ovens; also the class of coal used. The difference in the two results of toluene per ton of coal has a natural explanation—the 6 lbs. being from Lancashire coal and the 4·51 lbs. from Derbyshire coal.

The figures given as to the increase in the ash content of the coke as being obtained at the Birmingham experimental plant do not carry conviction, as calculation proves the inaccuracy of analysis or a difference in the coal. If 1·91 per cent. of calcium carbonate be added to coal which produces 65 per cent. of coke residuum, the result would be $\frac{56 \times 1{\cdot}91}{65} = 1{\cdot}65$ per cent. of CaO in the coke. Allowing for the increase in sulphur, the total increase of ash would be 1·74 per cent. The difference to be accounted for is thus 2·5 per cent. Most modern coke-oven plants could allow for 2 per cent. of ash in the coke, and still be within the usual allowance of 10 per cent.

Robert W. Preston.

Beeston, Nottingham, Jan. 15, 1916.

"Bye-Products of Carbonization"—Errata.

Sir,—Referring to my article, under the above heading, "collecting in 5 c.c. fractions" should read "collecting in 5° C. fractions." The yield of toluol from a crude 65's benzol, should be 12·5 per cent., not 25 per cent., as stated.

B. Dunglinson.

Jan. 15, 1916.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Municipal Expenditure (Scotland).

Mr. Currie asked whether the Government had indicated to any of the municipal authorities in Scotland who were at present engaged upon schemes for the acquisition of gas undertakings, or similar public utility schemes, that they will not be allowed to raise capital by borrowing for such purposes; and whether processes of arbitration in connection with such schemes are to proceed now or are to be indefinitely postponed, in view of the claims of recruiting on the already depleted staffs of municipalities and other staffs affected?

Mr. M'Kinnon Wood (the Secretary for Scotland) replied that sanction to raise loans for the acquisition of gas undertakings by Scottish local authorities had been refused in several cases during the past year. It was undesirable that local authorities should enter into commitments of the kind—including arbitration proceedings—at the present time. The expediency of suspending arbitration proceedings already in progress must depend upon circumstances.

Lighting of Railway Trains.

Mr. Bowerman asked the President of the Board of Trade whether, arising out of recent railway accidents involving the firing of carriages and consequent additional loss of life, representations had been made to the various railway companies suggesting the lighting of trains by electricity in place of gas; and, if such representations had been made, whether he would state the nature of the replies received?

Mr. Pretyman said that the Board of Trade had been in frequent correspondence with the railway companies on this subject, and they had recently asked the companies to consider what further steps they could take to accelerate the change from gas to electricity on main line and express services. The replies received showed that the companies generally have made considerable progress in effecting this change, but that the work had been interfered with owing to shortage of labour and material and other conditions caused by the war. The Board of Trade were fully alive to the importance of this matter, and it would continue to receive their careful attention.

Donations and Excess Profits Tax.

Sir J. D. Rees asked the Chancellor of the Exchequer whether donations for patriotic purposes were allowed as deductions in excess profits?

Mr. M'Kenna; The answer to the question is in the negative.

Coal Supply (West Riding of Yorkshire).

Mr. Sherwell on Monday last week asked the President of the Board of Trade if he was aware that the action of the Government in interfering with the supply of coal to manufacturing industries in the West Riding of Yorkshire was greatly accentuating the scarcity of coal already due to the shortage of mine labour and the lack of adequate facilities for railway transport, and that unless immediate steps were taken to remove, or to modify, the Government regulations, many important industries engaged on Government and export work would be compelled to close down, and large numbers of workers thrown out of employment? Was he also aware that in the West Riding of Yorkshire coalowners were being instructed to withhold the supply for the execution of their coal contracts in the interests of the manufacture of coke and the residuals of coal?

Mr. Runciman, in reply, said that if Mr. Sherwell would furnish him with particulars of the cases he had in mind, he would look into the matter. The Board of Trade had on particular occasions requested coalowners to give a preference to public utility undertakings and munition works, and they had called general attention to the necessity of maintaining adequate supplies to bye-product coke-ovens; but he was not aware of any regulations such as Mr. Sherwell had suggested.

Mr. Booth asked Mr. Runciman whether he was not aware that the Government were pressing manufacturers of coke very strongly for the need of benzol, and there was a great deal of difficulty in obtaining the slack to keep ovens going and so producing the bye-products indispensable for high explosives?

Mr. Runciman remarked this was the ground on which some communications had been sent out by the Board of Trade to some districts. The necessity of bye-products from some sorts of coal, of course, was always present to his mind.

Newmarket Public Lighting Contract.—On behalf of the Directors of the Newmarket Gas Company, Mr. J. H. Troughton (the Manager and Secretary) has written to the Urban District Council declining an offer of 7s. 6d. per lamp for the present lighting year, *plus* payment of the current price for all gas consumed. He points out that last year, when two-thirds of the full amount of gas was consumed, the Council paid for it, and also paid £136 as compensation for failing to take the remaining one-third. If no gas was used this year, the compensation should be at the same proportionate rate, or three times the amount paid last year. When the letter came before the Council at their last meeting, one or two members seemed to think the Company were rejecting a generous offer. It was, however, agreed that the matter should be discussed in committee.

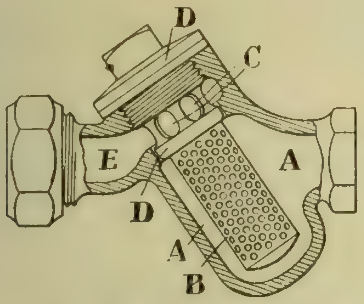
REGISTER OF PATENTS.

Strainers for Water-Meters.

Watson, F. M., of Rotherham.

No. 24,172; Dec. 16, 1914.

This invention has for its object to provide water-meters with filters or strainers at their inlets, which can be removed for cleaning or other purpose without having to disconnect the service pipe or meter.



Watson's Water-Meter Filter or Strainer.

The illustration shows the invention applied to one of two types of meters for which it is specially suited.

A is a chamber (attachable to the meter), to receive the filter or strainer B. It is here shown as a separable attachment, but may be cast in one with the body of the meter. The water enters the filter by the openings C, and foreign substances are retained in the strainer, as they are not able to escape through the small perforations in it. The foreign substances are, by the collar D, prevented from passing through from E into the chamber A—the collar being a sliding fit in the flange, or reduced portion, of the chamber A, as shown.

Treating Coal to Obtain, Oils, Ammonia, and Other Products.

Bergius, F., of Hanover.

No. 18,232; Aug. 1, 1914. Convention date, Aug. 8, 1913.

This invention consists in subjecting coal to the action of hydrogen at pressures above 10 atmospheres, and preferably exceeding 100 atmospheres, and at an elevated temperature less than 600° C. In these conditions the hydrogen, it is said, reacts directly with the coal, which is transformed without destructive distillation (and substantially without formation of uncondensable gases) into hydrocarbons which are either liquid at ordinary temperatures and pressures or which have a low melting point. The working temperature is preferably between 300° and 500° C.

The invention does not, the patentee remarks, consist broadly in the hydrogen treatment of solid carbonaceous material but only in the special kind of such treatment under the heat and pressure conditions mentioned for the purpose of transforming the solid carbonaceous matter directly into liquid or easily fusible hydrocarbon compounds. In particular, it is essential to employ a temperature of at least 10 atmospheres—very much higher pressures being preferably used. It is advisable, he says, to work in the presence of a solvent for the products formed during reaction; a suitable diluting medium being petrolium distillates. The nitrogen of the coal is obtained in the form of ammonia in the reaction vessel.

This hydrogenation may be combined with a carbonization process by subjecting wood or peat or other vegetable matter to heat treatment in a hydrogen containing atmosphere at high pressure—the hydrogen being supplied from a source different from the wood, peat, &c., under treatment; the working conditions being such that not more than very small quantities of hydrogen which are absolutely insufficient for the hydrogenation aimed at could be formed from the wood, peat, &c., under reaction.

The products produced in the hydrogenation process consist mainly of hydrocarbons having different boiling points, and which chemically resemble mineral-oil hydrocarbons. By far the greater part of these substances is liquid at an ordinary temperature; but the ash of the coal remains in the vessel as solid residues. The nitrogen of the coal escapes as ammonia with the hydrocarbons which have been distilled. The separation of the resulting condensed products can be effected in the usual manner by fractional distillation.

Condensing, Scrubbing, and Washing Apparatus.

Pooley, H., and Fiddes, G. B., of Leicester.

No. 24,598; Dec. 24, 1914.

This invention relates to apparatus for removing tar, dust, and other impurities from gases, or for absorbing any of the constituents of coal or other gases—such, for instance, as benzol or toluene.

Fig. 1 is a vertical section of the apparatus. Fig. 2 is a cross section. Fig. 3 shows in vertical section (drawn to a larger scale) a portion of one side of the apparatus.

The outer casing is of cylindrical formation, vertically disposed, and contains baffle-plates of conical formation, superimposed in nest fashion —sufficient space being left between the plates for the free passage of the gas. Alternate plates have central openings and the intermediate plates have holes near their peripheries, so that the gas, as it passes vertically downwards, is caused to impinge upon the surface of the plates and follow a zig-zag course in order to pass through the holes and openings, the arrangement of which is staggered. At the peripheries of the baffle-plates a liquid seal prevents any escape of the gas from between the plates.

In conjunction with each baffle-plate there is a gutter or channel A to collect and carry away the liquid and impurities—the gutters forming the liquid seal between the baffle-plates so as to prevent the escape of the gas, but will admit of the escape of the tar and other impurities. The impurities separated from the gas are carried away from the plates independently—that is to say, the impurities do not drop from one plate to another, so that to a very great extent clogging of the plates is avoided.

Each baffle-plate has depending from its edge, or from the gutter on it, a flange or cylindrical plate B, the lower edge of which is gapped at intervals or has formed in it apertures or bridge-like openings C. The lowermost plate is furnished with a deeper and ungapped flange D, resting on brackets in the interior of the shell, or else upon a platform or joists extending across the bottom part of the apparatus. The openings C are less in height than the depth of the gutters A, so that when the latter are full of liquid a seal will be formed to prevent the escape of gas from the inside to the outside of the flanges; but the openings allow liquid to pass.

The outer side of each gutter is provided with an outwardly extending lip or apron E, to prevent the liquid as it overflows and drops from the gutter of one plate falling into the gutter of the plate underneath. The lip, in the form of an annular ring or flange and by preference downwardly inclined, terminates in an edge which stands away from the side of the gutter to allow the extracted matters to fall. But to prevent the impurities falling from one baffle-plate to another, the holes F are surrounded by an upstanding lip or flange, attached to the baffle-plate.

Employed in conjunction with the plates is a nozzle G, to spray water, steam, or other solvent or cleansing agent over the baffle-plates, carry off the impurities separated from the gas, and to a certain extent serve for washing the gas as it passes through the apparatus. The nozzles preferably direct the spray upon the caps H of the plates so that as the gas passes through the central opening in one plate it will, as it impinges upon the apex of the cone underneath, also come into contact with the sprayed liquid. To this end each nozzle is supplied by a pipe I (leading from a main connected with the source of supply) fitted with a syphon to form a seal against back-pressure of the gas.

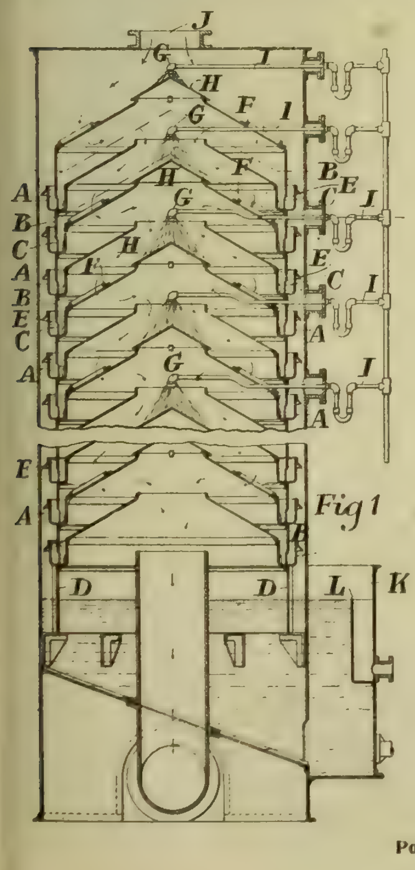


Fig 1

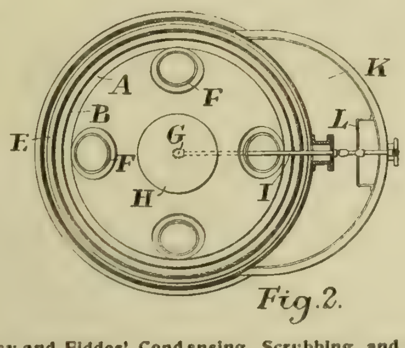


Fig. 2.

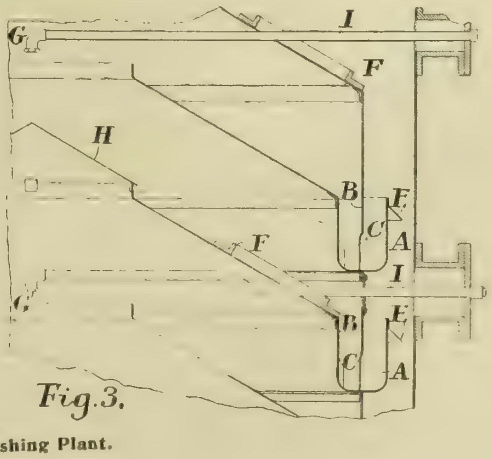


Fig. 3.

Pooley and Fiddes' Condensing, Scrubbing, and Washing Plant.

The case has at the upper end a gas inlet J (preferably but not necessarily centrally disposed) and at the bottom a tank K, the floor of which is downwardly inclined towards an overflow L and outlet for the liquid. The lower extremity of the flange D on the bottom baffle-plate extends into the tank and below the level of the water in it, and so forms a liquid seal to prevent escape of the gas round bottom end.

In operation, water or other cleansing agent is sprayed upon the baffle-plates, and the gas, on its passage down between the outside of the baffle-plates and the inside of the shell, is checked by the water-seal at the bottom; so that it is compelled to find its way through the holes in the uppermost baffle-plate and then on downwards between the whole vertical series of baffles, "during which, by impinging upon the different surfaces and contact with the cleansing agent, the impurities or constituents are separated from the gas and removed from the independent plates in company with the liquid—the gas passing down through the plates while the liquid and impurities or otherwise fall down on the outside thereof." The lighter impurities overflow with the liquid at L from the tank and pass away. The heavier impurities fall to the bottom of the tank, and, owing to the inclination of its floor, collect at one side, to which access may be had through the top for the removal of such residue when necessary.

The apparatus described is claimed to be especially advantageous in that it is easy to clean by the removal of the baffle-plates one after another; while water, steam, or other agent may be used at will, tar and heavy deposits are easily removable from the tank, and each baffle-plate acts independently of the other as regards discharging the impurities separated from the gas.

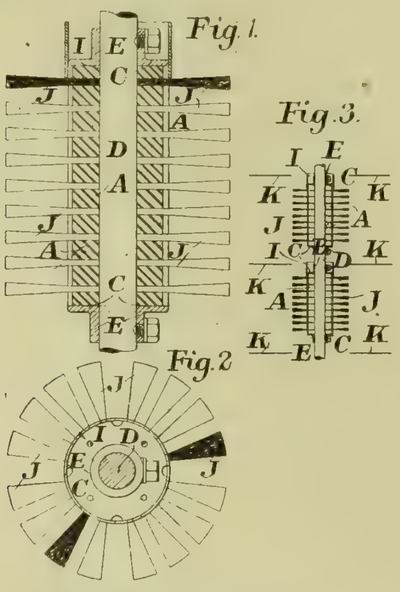
Purifying Gas.

Climie, W., jun., of Glasgow.

No. 1045; Jan. 22, 1915.

This invention particularly relates to the scrubber for washing gas and extracting tar as described in patent No. 11,136 of 1914, where the washing medium passes down through a series of perforated plates arranged in the scrubber, which is also fitted with a shaft having blade-carrying arms or rotary discs.

According to the suggested improvement, brush devices, consisting of blocks having fibre, wire, or other suitable material inserted into them and carried between discs secured to the central shaft, are arranged in place of the blade-carrying arms or rotary discs in the interior of the scrubber, so as to act as a gas forcing and mixing medium. The diameter of the central hole in each perforated plate of the series of plates arranged in the apparatus is preferably not less than the overall diameter of the brush devices, so that the central shaft can be raised out of the scrubber for examination, cleaning, &c., without removing the perforated plates.



Climie's Gas Purifying Apparatus.

Fig. 1 is a sectional elevation of one of the brush devices fitted to the shaft of the scrubber; fig. 2 is a plan; fig. 3 is a similar view to fig. 1 (to a smaller scale) showing a number of brush devices arranged between the discs of the scrubber.

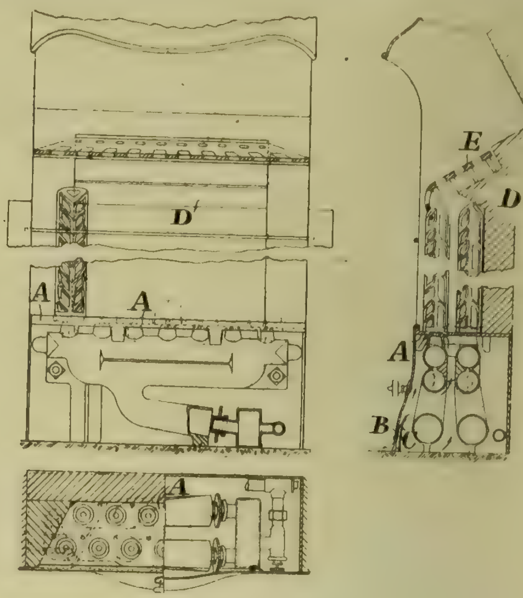
Each brush device consists of a number of blocks A, preferably of wood, secured between discs C carried by the shaft D. The discs, formed with bosses E, are secured to the shaft, and the blocks are arranged equidistantly round the shaft; bands G being arranged to encircle them so as to retain them in position. The bands (secured to the blocks) extend upwards beyond the upper face of the upper disc C so as to form a well I. Fibre, wire, or other material J is secured in the outer surfaces of the blocks, so that each block with its fibre forms a brush; while the series of brushes arranged between the discs K (fig. 3) form a brush device. Grooves are formed between the meeting faces of the blocks, so as to conduct the liquor to the lower brush part of the blocks.

Gas-Fires.

Grafton, W., of Glasgow.

No. 8986; June 18, 1915.

This invention has for its primary object to provide a gas-stove such as "to ensure perfect combustion with more complete utilization of the heat due to combustion, and to obtain regenerative effect consequent upon the preheating of the mixture of gas and primary air and part of the secondary air supply, and to ensure silence during the process of combustion."



Grafton's Gas-Fire.

The gas-fire shown is furnished with two separate bunsen tubes, each tube provided with upwardly projecting nozzles—arranged in staggered relationship. Above the burner tubes is a metallic grid A or plate apertured for partial penetration by the nozzles, with clearance for the passage of some small volume of preheated secondary air. The plate is a conductor of heat, and is formed with depending ribs resting on the burner tubes "so as to establish thermal connection between the burner tubes, which are otherwise entirely separate from one another." The upper face of the plate is formed with upstanding lugs to maintain the radiants in position. The arrangement is "such that the radiants completely fill up the front of the fire; the entire surface visible from the front constituting a combustion chamber and heat-radiating surface." The lowest part of the fire is closed against ingress of air, save what enters through an opening B at the fret front or side—such opening being "of a determinate area calculated as the result of experiment for each standard form to ensure that the gaseous mixture passing through the nozzles is explosive." The air (chiefly primary air, with some secondary air) passing through the opening must flow in the direction indicated by the arrows to secure recuperation, past a baffle C, through, around, and between the burner tubes, which themselves become heated partly by radiation and partly by conduction. A supplemental supply of secondary air will also pass direct to the radiants from the place in which the fire is used; "but such supplemental supply is not under control, as distinguished from that passing through the opening B."

In order to confine the passage of the gaseous products before passing to the chimney, the back brick is formed with a shoulder D or an abrupt projecting brick at or about right angles to the plane of the back brick and surmounting the back radiants—the extreme ends of the shoulder being formed in one with the side bricks, or resting on the side bricks; the upper face of the shoulder being inclined and surmounted by a top radiant E. The shoulder forms a dam for the hot currents rising in the shallow chamber containing the radiants; "the arrangement being such that during the combustion of the gas the bricks are rendered red hot, whereby the heat of combustion is husbanded, the bricks constituting a thermal storage from which and the top radiant heat rays are projected into the room."

The patentee concludes his specification thus: "As is evident, the lower face of the shoulder is adapted to be heated by the gaseous products from the rearward radiants, and the inclined upper face of the shoulder is adapted to be swept and heated by the gaseous products from both rows of upright radiants, while it also serves as a reflector in respect of the top radiant. In these respects the shoulder provided in my construction performs a function quite distinct from that of an inclined fire-back as heretofore provided."

Trinitrotoluene Manufacture.

Roberts, D. C., and Stuart, O., of Liverpool.

No. 7047; May 11, 1915.

This invention relates to a method of recrystallizing trinitrotoluene with the object of purifying the crude product so as to obtain a product having the right melting point, which, as at present prescribed by the Government specification, is 80° to 81·5° C. The proposal is to employ ordinary commercial mononitrotoluene—*i.e.*, the product which can be obtained by the mono-nitration of toluene consisting (for instance) in a mixture of 42 per cent. of the para-isomer, 55 per cent. of the ortho-isomer, and 3 per cent. of the meta-isomer.

As an example, the patentees say 2000 lbs. of crude trinitrotoluene are heated with 750 lbs. of ordinary commercial mononitrotoluene at 80° C. The solution is filtered and cooled to a temperature not below 16° C., so that the lower nitration products will not crystallize out. When the crystallization is complete, the mother liquor is separated from the crystals by a centrifugal or press, and the crystals are rinsed with a small quantity of cold alcohol—preferably not absolute alcohol, but aqueous alcohol, containing 40 per cent. of alcohol and 60 per cent. of water. The use of this mixture obviates the risk of dangerous fires.

The product is of a light colour, and has a melting point of 80° to 81·5° C. A yield of 90 to 95 parts of pure trinitrotoluene is obtained from every 100 parts of crude trinitrotoluene. The nitrotoluene remaining in solution can be at all events partially renitrated.

If the same solvent has been employed repeatedly, care must be taken in renitration, since it has been found that there is a tendency towards an accumulation of the dangerous nitrobenzoic acid and azo compounds which remain in the mother liquor each time if they are present in the crude trinitrotoluene. These difficulties can be avoided, however, if the solvent is purified by distillation in steam—thus giving a pure product, which may be used for renitration or recrystallizing.

Trinitrotoluene Manufacture.

Roberts, D. C., and Stuart, O., of Liverpool.

No. 9466; June 29, 1915.

This invention relates to an improved method of recrystallizing trinitrotoluene, with the object of obtaining a pure product, having the right melting point—that at present given in Government specifications being 80° to 81·5° C.

The patentees suggest that 2000 lbs. of crude trinitrotoluene should be heated with 750 lbs. of nitro-benzene at 70° C.; and the solution filtered and cooled to approximately atmospheric temperature. When the crystallization is complete, the mother liquor is separated from the crystals by a centrifugal or press, and the crystals are rinsed with a small quantity of cold alcohol—preferably aqueous alcohol containing 40 per cent. of alcohol and 60 per cent. of water. The use of this mixture is said to obviate the risk of dangerous fires. The product is of a light colour, and has a melting point of 80° to 81·5° C. The nitrobenzene is purified by distillation in steam, and can then be used again as solvent in a fresh recrystallization.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Jan. 12.]

For convenience of reference, the applications are now arranged alphabetically under the names of the applicants and communicators; the latter being printed in italic type. In the case of joint applicants or communicators, each name is given independently. A new number will be given when the complete specification is accepted, or becomes open to public inspection before acceptance. The date which the patent will bear, if granted, will appear in a subsequent list of complete specifications accepted.

Nos. 1—386.

Carpenter, H. A.—"Operating generators." No. 336. "Charging and discharging gas-retorts." No. 337.
Chandler, D.—"Gas-furnaces." No. 10. "Crucibles to be used with gas-furnaces." No. 176.
Davis, H. N.—"Gas-burners." No. 75. "Gas-fires." No. 76.
Dawson, R.—"Coin-freed gas-meter." No. 217.
Drake, W. A. and Drakes, Limited.—"Regenerative furnaces." No. 7.
Fletcher, W.—"Gas cooking-rings." No. 91.
Habicht, P.—"Gas-heated flat-irons." No. 123.
Hall, I.—"Burners." No. 47.
Ham, M. B.—"Combined holder for packing and adjusting inverted mantles." No. 350. "Adjustable incandescent ring for inverted mantles." No. 351.
Hibbard, R. L.—See Carpenter. Nos. 336 and 337.
Ionides, A. C.—"Combustion of gaseous mixtures." No. 129.
Riter-Conley Manufacturing Company.—"Operating gas-generators." No. 335.
Riter-Conley Manufacturing Company.—See Carpenter. Nos. 336 and 337.
Ruthven, R. H.—"Extraction of toluol, benzol, and other hydrocarbons, from gas." No. 74.
Shakespear, G. A.—"Detection and measurement of gases." No. 112.
Snell, C. Scott.—"Gas-fires." No. 106.
South Metropolitan Gas Company.—See Chandler. Nos. 10 and 176.
Theisen, H. E.—"Atomizing apparatus for purifying, cooling, and mixing gases." No. 225.
Thomson, W.—See Ruthven. No. 74.
Towl, A. Pearce.—See Fletcher. No. 91.
Twigg, W. R.—See Davis. Nos. 75 and 76.
Walker, W. C.—See Fletcher. No. 91.
Warner, A. W.—See Carpenter. Nos. 336 and 337.
White, A. E.—See Riter-Conley Manufacturing Company.—No. 335.

Leakage at Sutton-in-Ashfield.—At the last meeting of the Sutton-in-Ashfield Urban District Council, Dr. F. D. Martyn directed attention to the fact that the Auditor's report attributed the reduced profit on the gas undertaking to leakage from the mains; it being said that steps were being taken to effect a remedy. The leakage was put down at 13 per cent., which was a serious item. It had been urged that they should all economize at this time in respect of personal expenditure; and he thought some economy should be exercised regarding such a formidable leakage as was here revealed. Mr. Briggs (the Chairman of the Gas Committee) explained that the leakage had increased by 2 per cent. since last year, which he suggested was not a big loss compared with other places. Since he had been on the Council, the leakage had been as much as 30 per cent.; but it had been gradually worked down to 11 per cent. The leakage was due to the fact that there were so many colliery workings in the district; and occasionally some little time elapsed before the leakage was discovered.

LEGAL INTELLIGENCE.

A CLAIM FOR GAS POISONING.

Jury Stop the Case.

At the Berkshire Winter Assizes, Reading, on Thursday and Friday of last week, Mr. Justice Avory and a Special Jury were occupied in hearing the case of *Lockyear v. Kingsclere Board of Guardians*, in which the plaintiff claimed damages for the breach by the defendants of a legal duty and (or) of an implied contract not to expose her to unreasonable risk and danger while she was in the employment of the defendants; and, alternatively, damages for personal injuries caused by the negligence of the defendants or their servants in exposing her to an escape of gas by which she was poisoned.

Mr. Powell, K.C., and Mr. Ratto were Counsel for the plaintiff; Mr. Vachell, K.C., and Mr. Mickleswaithe appeared for the defendants; while Mr. R. C. Owen-Wells held a watching brief for a party interested.

The statement of claim set out that plaintiff was employed by defendants as assistant nurse at the Kingsclere Poor Law Institution. In the course of such employment, plaintiff performed night duty on alternate months, and was obliged to occupy a certain duty room, which was lit by coal gas. On or about Nov. 8, 1913, while occupying this room, she noticed a smell of coal gas, caused by a leakage in the gas-fittings or connecting-pipes. In about a week the odour became more apparent; and plaintiff thereupon saw the Master, and requested him to cause the defect to be remedied. Several days after, as no steps had been taken, plaintiff reported the matter to a porter at the institution. About midnight on Nov. 25, 1913, while on night duty, plaintiff was suddenly taken ill with violent pain and sickness, which continued the following day and night, and prevented her attending to her duties. Dr. Maples, Medical Officer of the institution, examined her, and pronounced her suffering from poisoning caused by the inhaling of putrid coal gas. Her condition became rapidly worse, and she suffered great agony, and occasionally completely lost consciousness, and for a considerable time was in danger of losing her life. Except for a period of about a fortnight, the defendants provided medical attendance and nursing for plaintiff at the institution, until Nov. 7, 1914, when she was removed to the house of her sister at Newbury, and was till about March 7, 1915, attended by Dr. Adams, on whose advice she was removed to the Royal Berkshire Hospital, Reading. Since May 25, 1915, she had been treated at her home, and attended by Dr. Heywood. As a result of her illness plaintiff completely lost the use of her legs, so that she could neither walk nor stand, and she was still unable to walk without assistance. The defendants, after notice, discharged plaintiff from their service at the end of March, 1915, since which time, owing to physical weakness and nervous breakdown, due to her long and severe illness, the plaintiff had been unable to follow any employment. Special damages were set out, amounting to a total of £61 10s., and the plaintiff claimed £500 as damages. In their statement, the defendants denied that there was any leakage in the gas-fittings or connection-pipes, or any escape of gas, and also that the illness of plaintiff was caused by gas, or arose from any neglect or default on the part of the defendants or their servants.

Mr. Powell, in his opening statement, admitted that the case was of a somewhat unusual character. The Guardians or their officials had not taken due care in seeing that gas of the best quality should be supplied, and that the fittings should be efficient; while on complaint being made that something was wrong, prompt steps should have been taken to remedy the defect. He did not know whether the Guardians would have any remedy against the Gas Company; but the plaintiff's case was against the Guardians.

Plaintiff bore out the opening statement, and medical evidence was then called, after which

Mr. *W. R. Davey*, the Manager of the Gas-Works at Newbury, said he was acquainted with the Kingsclere Gas-Works, which he supposed were established about fifty years ago. Some portions of the plant were excellent, and others were quite obsolete. The purifiers were just about equal to, or a little below, their capacity. If an extra quantity of gas was made at any time, the result must be that a considerable amount must go forward without the sulphuretted hydrogen having been removed. He did not understand the phrase "putrid gas." The characteristic smell of sulphuretted hydrogen was that of rotten eggs.

E. W. White, a gas-fitter employed at the Newbury Gas-Works, said on March 9, 1915, he inspected some gas-fittings in the duty room at the Kingsclere Poor Law Institution. The joints of the pendant were very loose; and about 2 feet of the main (compo.) pipe on the ceiling, from which the light depended, had a corked hole, not sealed over, from which a connection had apparently been taken off. He found no leak.

This closed the case for the plaintiff.

Mr. Vachell raised the point that the statement of claim in the pleadings had not been borne out that the illness was caused by a leakage of gas from the fittings, plaintiff herself saying that nothing was perceptible until she lit the gas.

His Lordship said it was quite clear a different case was now put forward. There had been no evidence of an escape of gas.

Mr. Vachell, in addressing the Jury, said that plaintiff must have damages if they were satisfied that she had suffered in consequence of some defect in the gas supply, and that, if there was such defective supply, it was due to the negligence of the defendants. There was no guarantee by the Guardians that the atmosphere of the house should be pure—they could only take ordinary and reasonable care.

Mr. *Walter H. Bell*, an architect and surveyor, put in a plan of the duty room. One of the windows would open; and there were two fixed lights.

Mr. *J. R. P. Thomas*, the Master of the institution, in his evidence, said the smell of gas became objectionable throughout the house on Nov. 21; but there was no smell when it was burning. The smell lasted three days. The gas was not cut off at the meter, because there was a lamp on the service which lighted a dangerous corner. Plaintiff never complained of any escape of gas, nor of the gas smelling. He never noticed any smell except during the time mentioned.

In cross-examination, witness said the complaint of the gas was general throughout the village. He warned plaintiff not to burn gas in the lying-in or sick wards, but said nothing in particular about the duty room.

Dr. *Reginald Maples*, Medical Officer of Health for the Kingsclere Rural District area, said he had attended plaintiff for a few months of her appointment. She frequently ailed from gastric trouble, which he attributed to chronic ulceration of the stomach. About Nov. 15 there was no sign of escape of gas, and the odour was not remarkable. As to his entry on Nov. 21 respecting "putrid gas," he stuck to these words. He condemned the gas, and the whole of the district was the same. He had several patients affected in the same way. He certainly did not attribute her condition to escaped coal gas—she was certainly suffering from ptomaine, and was dangerously ill at the time. She continued under his care until Feb. 7. In the cupboard used by her he found patty-pans which were mouldy and covered with verdigris, and a very dirty baking tin. He thought that they were undoubtedly a possible source of the ptomaine poisoning. It was absolute imagination that he said to any of the assistants that plaintiff was suffering from gas poisoning, or that he said to plaintiff that he had condemned the gas, or that ptomaine poisoning was caused by the gas and not by the food she had.

In cross-examination, witness said from the first he had undoubtedly been of opinion that it was food poisoning. He told Mr. Thomas, the Master, that plaintiff's statement that he had said she was suffering from the effects of putrid gas was not correct. He believed that eating from the dirty tart or patty pans was the cause of the illness, and it had nothing to do with gas.

Professor *H. Wilson Hake*, Ph.D., gave evidence that in his opinion plaintiff's symptoms could not possibly have been caused by an escape of gas—still less by inhaling the products of burnt gas.

Other evidence having been called, the Jury stopped the case and found for the defendants, for whom judgment was accordingly entered.

[Mr. Norton H. Humphrys, of Salisbury, was retained as technical adviser and witness for the defence; but the case was stopped before his evidence had been called for.]

WATER-GAS PLANT PATENTS IN AMERICA.

United Gas Improvement Company v. Gas Machinery Company.

The Gas Machinery Company, of Cleveland, Ohio, write stating that the suit against them brought by the United Gas Improvement Company charging infringment of the Rusby patent No. 857,760, which it was claimed covered an air-metering device for water-gas apparatus, has been decided in their favour. They submit the following statement relating to the suit:

About three years ago the United Gas Improvement Company sued the Gas Machinery Company, charging infringement of the Rusby patent No. 857,760, held by them to cover the attachment of an air-metering device to water-gas apparatus, and the Dickey patent (No. 940,925) said to cover the attachment of a steam-metering device for water-gas apparatus.

The case was tried before Judge Day in the United States District Court at Cleveland, Ohio, the latter part of 1913. In deciding the case, the Court held that the Dickey patent was invalid, but that the Rusby patent was valid, and had been infringed by nine water-gas sets that the Gas Machinery Company had installed and had provided with Pitot tube air-meters.

The Gas Machinery Company appealed from Judge Day's decision, in so far as it related to the Rusby patent. The United Gas Improvement Company, however, did not appeal from the part of the decision which held that the Dickey patent was invalid.

The Court of Appeal for the Sixth Circuit has just handed down its decision on the appeal taken by the Gas Machinery Company, and has reversed the judgment of the Lower Court, and held that the Rusby patent is also invalid.

The reason stated by the Court for their decision is that the specification discloses an unpatentable aggregation of old elements, and not a patentable combination of co-acting elements. Concerning this particular point, the Court say in their opinion: "We conclude that the relation of Rusby's ajutage and gauge to the 'set' is the relation between the items of an aggregate, and not the relation between the elements of a combination. This conclusion depends on the general proposition that a metering device—the only office of which is to measure the raw material entering a machine, so that the operator may stop when he has put in enough—does not so co-act with the machine itself as to be properly characterized as being in combination therewith. The operation of the ajutage is as obscure as its name is unfamiliar; but in spite of this, it does nothing except indicate, and, in a sense measure, the entering air. It does not co-operate with the three main members of the set any more than does the oil-measuring device or the steam-measuring device, or, for that matter, the scales that weigh the coal. Indeed, it is just as important to the operator to know the period of elapsed time as it is to know the rate of flow of the air; and the clock that tells him when to close the valve fully is as essential to the gas-making operation as is the gauge which tells him when to shut it part-way. It is only another form of expressing the lack of real combination to say that the gas-making apparatus does not extend beyond the gates at which the materials enter; and it is only fortuitous that the air-measuring device happens to be set close to the entrance valve. It might as well be in another room. Upon principle, it seems clear to us that a mere measuring device, which does nothing, and can do nothing, except give the operator information as to how much material is going into the machine, is no part of a true combination of the operative elements of the machine; and we can find no case where the contrary has been held."

MISCELLANEOUS NEWS.

SULPHATE OF AMMONIA AND NITRATE OF SODA.

Messrs. Bradbury and Hirsch's Market Review for 1915.

The great disabilities under which they have been labouring in its preparation, owing to the international situation, are emphasized by Messrs. Bradbury and Hirsch, of Liverpool, in the opening lines of their "Review of the Sulphate of Ammonia and Nitrate of Soda Markets for 1915"—a copy of which has come to hand. They say that the circumstances existing at the beginning of the year, and the new factors which have come into play during the year, have been so far abnormal that previous business experience has been practically useless for guidance. The year's experience, however, ought to make it possible to take more reliable views of the outlook than was the case twelve months ago, as there has been time for adjustment to the altered circumstances. But there will necessarily have to be a re-adjustment when the war comes to an end; and that time may conceivably occasion as many trying situations as the course of the war has disclosed. Again the hope is expressed that, before the time arrives for writing the next review, peace may have been established on a solid and satisfactory basis.

NITRATE OF SODA.

Nitrate of soda is first dealt with in the review; and as to this, Messrs. Bradbury and Hirsch remark that the conditions which have prevailed during the past twelve months have been so far exceptional that they cannot be compared in any way with those which have governed the market during any other period in the trade's history. It would be useless, therefore, to attempt to establish any comparison between 1915 and the previous year, or any other year, or to reason on the lines hitherto followed. Moreover, inasmuch as complete figures representing deliveries, &c., in Europe are not obtainable, they think it would serve no useful purpose to give the figures which are procurable. The outstanding facts in the situation at the end of 1914 were the stoppage of direct shipments to Germany and Belgium, unprecedentedly heavy stocks on the west coast, and, on the other hand, a rapidly decreasing output. There might, perhaps, be added the fact that in the United States there was a shortage of supplies, which were bound to be replenished early in 1915, though this fact was only of minor importance in relation to the other three. Demand for munition purposes had hardly made itself seriously felt. When it is pointed out that the imports into Germany and Belgium in 1913 amounted to about 1,150,000 tons—or nearly twice as much as those into the rest of Europe, including Egypt, during the same period—it will be appreciated how serious a matter it was that such an outlet should be blocked. Of course, it was known that supplies would find their way indirectly into Germany and Austria; but manifestly such supplies could not constitute a serious offset against the shrinkage in direct shipments referred to. The west coast stocks at the end of 1914 were estimated at about 1,120,000 tons—an increase of 625,000 tons during the year, and due largely, though not altogether, to the outbreak of the war and consequent shrinkage in shipments. The increase in stocks up to the end of July had, in fact, been such that the curtailment of output was under consideration when the war broke out; and some thirty to forty officinas had already been closed-down. From that time up to the end of 1914, the process of closing-down had been steadily proceeding.

The Course of Prices.

The most prominent factors during the year, the report proceeds, were the continued closing-down of officinas in the early months, and the re-opening of them when the market improved, the phenomenal advance in freight rates, and the almost world-wide demand for nitrate of soda for munition purposes. By the end of March, only about one-fifth of the total number of officinas were still working; but from April forward there was a well-sustained demand up to September, when the stoppage of the Panama Canal gave a further impetus to buying, and within a month a very large business resulted at up to 9s. 7d. per quintal. When fresh chartering had to be done, however, it was found impossible to secure the necessary tonnage, even at the further inflated freight rates which the fresh demand brought about. With advancing free alongside prices, officinas had re-opened; and at the close of the year the output was fully equal to that before the war. Manifestly, the firm say, it has outstripped the world's requirements, including the very large requirements for munition purposes, with Germany out of the market; and they do not see that the inflated prices paid in October were justified, even if freight room had been obtainable. Before October was out, there was a relapse in prices; and at the close the value was not more than about 7s. per quintal. Whether even 7s. per quintal can be maintained, is more than doubtful, unless producers very soon come to an agreement to curtail production all round. Having regard to prices current in Europe and the United States, the year's working cannot be considered as very satisfactory from the point of view of producers. Importers have probably good reason to be satisfied; but undoubtedly the lion's share has gone into the pockets of shipowners.

From 10s. per cwt. at Liverpool at the outset, there was an advance to 10s. 4½d. in January, to 11s. in February, to 11s. 6d. in March, and to 12s. 6d. in April. After advancing to 13s., there was a decline to 12s. 6d. in May, and to 12s. 1½d. in June. There was a recovery to 12s. 3d. in July; and in August 13s. 9d. became the price. There was a decline to 13s. 4½d. in September; but in October there was an advance to 14s. 4½d. Through November the price remained at 14s. 4½d.; but in December it was put up to 15s. 3d. The average price for the year worked out to 12s. 4½d. per cwt. When the year opened there was hardly a west coast market at all; and the nominal value of ordinary quality was not more than about 5s. 6d. per quintal, free alongside. In February, there was an improvement in tone, and 6s. per quintal became the quotation. There was a gradual improvement in March; and in April 6s. 6d. was paid. There was an advance to 6s. 9d, in May, to 7s. in June, and to 7s. 7d. in July. In August 8s. 3d. was reached; and in September as much as 9s. 3d. was paid. Up to 9s. 7d. was paid in October; but from that time there was a steady decline, and at the close the value was not over 7s. The average price for the twelve months was 7s. 7d. per quintal.

The nominal freight rates at the end of 1914 were about 30s. and 60s. per ton, for sail and steam respectively. For sail, all through June, July, and August, 1915, the rate was fairly steady at about 65s. per ton; while the rate for steam was 80s. per ton in August, and 82s. 6d. in September. The blocking of the Panama Canal led to extra demand for tonnage in October, especially for steam; and a big advance in rates was demanded. At the close, there would probably be charterers at 85s. per ton for sail and at 125s. per ton for steam, for early 1916 loading. It will, it is added, thus be seen that the question of tonnage has been the governing factor in the nitrate of soda trade in 1915; and that if tonnage had been sufficiently plentiful, there would have been an abundant supply of nitrate of soda for all purposes.

As to prospects, although the firm feel that they cannot attempt to prognosticate in the absence of sufficient data to work on, there are several facts which seem to have a bearing upon the present situation. The exports from the west coast to Europe (including Russia) in 1915 were something over a million tons, against less than 2 million tons in 1913, when Germany and Belgium together took nearly two-thirds of the whole. The margin provided for munition purposes by the shipment of upwards of a million tons in 1915 would seem to be more than sufficient had the Panama Canal not been blocked; and, but for this accident, they hardly think there would have been such an advance in prices as occurred within the past three months. Then, shipments to the United States in 1915 were about 800,000 tons—nearly 300,000 tons more than in 1914. From this, one would argue that at the present time the United States is probably well supplied, notwithstanding increased use for chemical purposes; and that it will be less keen to compete for available tonnage on the west coast than will buyers for the European market. If the Panama Canal is re-opened at the end of January, as anticipated, there may be a chance of easier prices as larger supplies become available; but otherwise the firm think that even a higher level of prices may be reached before the spring months are over. The stocks on the west coast are estimated to be about 800,000 tons. They are still increasing, and there will be no indisposition on the part of producers to sell. But so far as the European market over the spring months is concerned, nothing will depend upon this.

SULPHATE OF AMMONIA.

Turning now to the question of sulphate of ammonia, Messrs. Bradbury and Hirsch say that in their concluding remarks upon the situation at the end of 1914 they expressed the opinion that one might dismiss Continental production from consideration, inasmuch as it could only find its way to the world market through Holland and Italy, even if supplies were available, and that it was not likely that exports on any extensive scale could be sent through these countries under the conditions then existing. This view necessarily led to the further conclusion that the prospects of the market must be considered from the point of view of output in the United Kingdom and the United States; the output outside these two countries, and available, not being enough to have any appreciable effect upon the market. Seeing, too, that more than the whole output in the United States is always required for home consumption, they thought the problem might be further narrowed, and considered solely from the point of view of the United Kingdom supply.

From the above starting-point, they had to consider the prospect of an adequate demand; and, in the first place, it seemed likely that the stoppage of shipments to Germany and Belgium might be balanced by the larger demand from France, Italy, and Spain, since all these countries had drawn some supplies from Germany in 1914. Then, the exports from Germany and Belgium to Holland and the Dutch East Indies, in January-April, 1914, were nearly 30,000 tons; and if the opinion that Germany would not have any sulphate of ammonia to spare in 1915 was correct, it followed that Holland and the Dutch East Indies would have to depend upon the United Kingdom for their supplies. It was within the firm's knowledge that buyers in the United States had had to cancel contracts for German output; but it had also transpired that they were cancelling contracts with the United Kingdom. So it did not necessarily follow that British output would have to be substituted for the German shortage in the early months of 1915. The cotton-growing industry in America was, in fact, in such a demoralized condition that it was not clear what the upshot of the campaign in that country might be; but the prospects were by no means bright. There had been a heavy falling-off in shipments to Japan during the preceding six months; and it was not possible for the market to count with confidence upon that country for support over the coming season. There was, however, in the price of sugar and in prices of all cereals every inducement to fertilize on the most liberal scale outside the war area; and inasmuch as nitrate of soda does not seriously compete with sulphate of ammonia outside the Continent, unless in the United States, they anticipated a still higher level of prices for sulphate of ammonia over the spring months of 1915—German output not being available.

EXPORT BUSINESS.

Though, of course, new factors came into play to disturb calculations, Messrs. Bradbury and Hirsch point to the tables of exports, to show how far their anticipations were justified. These indicate the total exports for the past two years to have been as follows:

	Year 1915. Tons.		Year 1914. Tons.
France, Germany, and Belgium . . .	11,430	..	6,945
Spain and Portugal, Italy, and the Canaries	77,113	..	72,855
Holland, Java, British Guiana, the West Indies, and Mauritius	161,974	..	86,510
Japan	10,537	..	87,776
United States	16,377	..	43,651
Other countries	16,877	..	16,140
Total exports	294,308	..	313,877

Commenting on the tables [for the details in which readers must be referred to the review itself], the firm point out that the January-March table shows there was not the increase in shipments to France which was expected. An increase of 19,549 tons to Holland inside three months, on the top of heavy shipments towards the close of 1914, was too significant to be overlooked; and the Government took action to control further shipments in this direction. The extraordinary shrinkage in the shipments to Japan was accounted for by the fact that freight room to Europe had become so scarce, and freights so inflated, that it was impossible to export more than a portion of the bean crop to advantage. The falling-off in requirements for the United States was in January, while the cotton-growing outlook was still in suspense; and the absence of any recovery later was no doubt due to larger home output. The January-April table shows that the measures taken by the Government to control exports had been effective, and that shipments to Holland had been brought to a full stop. There was a further shrinkage in the shipments to Japan and the United States; but there was a very satisfactory recovery in French requirements. The January-June table shows that, whereas at the end of April shipments to Spain were in arrears to the extent of 7362 tons, they were at the end of June 1280 tons ahead of the shipments for January-June, 1914. The largest 1915 shipments held up in April owing to insufficient freight room had been shipped in May and June. The shipments to Holland in May and June were under effective control, and were only slightly in excess of those in May and June, 1914. Those to the United States were about on a level with those in May and June, 1914; but within the same period there was a shrinkage of no less than 11,633 tons in the shipments to Japan. On a survey of the whole six months, the outstanding features are the shrinkage of 39,969 tons in the shipments to Japan and of 7615 tons in those to the United States, against increases of 21,557 tons in the shipments to Holland, of 15,050 tons to the sugar-growing Colonies (including Cuba), and of 5790 tons to other countries, of which 5490 tons went to Sweden and Denmark. Had Japan been buying on anything like her previous scale, there must have been a sulphate of ammonia famine and corresponding prices; while with Japan almost "out of the hunt," but for the intervention of Holland and Sweden there must have been a glut of supplies and a slump in prices. It has been attempted to show that the excess quantity taken by Holland and Sweden up to the end of March—25,039 tons—and which occasioned the action of the Government, was required to replace what had been taken from Germany in other years. But the figures are altogether against the contention; the Dutch import from Germany in January-April, 1914, having been only 11,946 tons, and in 1913 only 9238 tons, while Sweden took none. Under the conditions prevailing, the reviewers do not think that a shrinkage of only 4468 tons in the total shipments from the United Kingdom over the six months can be regarded as other than satisfactory.

The striking features about the July-December figures are the remarkable increase in shipments to the sugar-growing Colonies and the further shrinkage in shipments to Japan The total shipments to Java from the United Kingdom in 1915 were 93 496 tons—figures never even approached when that country was exclusively supplied by the United Kingdom. The shrinkage of a further 37,270 tons in the shipments to Japan was not unexpected; but the shrinkage of 19,659 tons in those to the United States is not so easily explained. Of course, the United States imported much larger supplies of nitrate of soda, and these may to some extent have ousted sulphate of ammonia; but the firm think the increase has been very largely used for other than agricultural purposes.

If the exports for the whole year are compared with the exports in 1913, it will be seen that the entire trade has been turned upside down by the war, either directly or indirectly. The exports to the Continent have shrunk from 23,521 tons in 1913 to 11,430 tons in 1915, those to Japan from 114,684 tons in 1913 to 10,537 tons in 1915, and those to the United States from 37,067 tons in 1913 to 16,377 tons in 1915; while the shipments to Holland and the sugar-growing Colonies have increased from 60,275 tons in 1913 to 161,974 tons in 1915, and home consumption (for all purposes) from 105,000 tons in 1913 to 128,000 tons in 1915. Exports to Spain have also increased substantially; and they would have made a still better showing if permits to ship had been granted more freely.

THE COURSE OF PRICES.

On the subject of prices, Messrs. Bradbury and Hirsch remark that no recent year has opened under more favourable conditions, from the British sulphate of ammonia manufacturers' point of view, than 1915. With Germany out of the competition, and with the prospect of exceptional demand for the sugar-growing Colonies, the way to ample demand and to higher prices seemed to be quite clear from the outset. Probably the advance from £12 2s. 6d. to £13 13s. 9d. per ton in January was more than was expected, having regard to the mild fluctuations which the market had been accustomed to over so many years. The set-back to £13 12s. 6d. per ton in February, to £13 10s. in March, and to £13 8s. 9d. in April, was due in the first instance to the defection of Japan and the United States; but it was contributed to in April by Government intervention in regard to shipments to Holland, and by the inadequacy of railway and shipping facilities—the shrinkage in the total shipments up to the end of April, compared with the shipments in January-April, 1914, being no less than 10,032 tons. Belated shipments, more particularly those to Spain, were, however, made good in May and June; and there was a recovery to £13 17s. 6d. per ton in May, and to £14 8s. 9d. in June, by which time Government requirements for munitions had begun to make an impression.

By the end of the first week in July, the upward movement had spent itself, belated shipments having been disposed of, and there being no other special demand; and the market was quiet up to the close, when the price was £14 13s. 9d. per ton. Owing mainly to the difficulty in obtaining shipping permits from the War Trade Department, and to the hesitancy of buyers abroad about placing further orders, the price gradually declined to £14 10s. per ton in August. There was very little fluctuation in September; and at the close £14 10s. per ton was still the price. In October, however, there being a well-sustained demand, there was a steady and rapid advance from the outset up to the close, when £15 7s. 6d. per ton had been realized. By this time, Government requirements for munition purposes had become a real factor in the situation; and the reservation, at the instance of the Board of Agriculture, of a proportion of the output of sulphate of ammonia for home agricultural purposes had also to be taken account of by buyers. Moreover, the Government strings controlling shipments to Holland had been slackened. The consequence was a strong demand from practically all foreign markets, excepting the Japanese, and an advance in prices up to £16 7s. 6d. per ton—the highest point reached since 1883.

The average price for January-June was £13 10s. 7d. per ton, or £1 13s. 3d. above the average price for January-June, 1914. The average price for July-December works out to £15 4s. 7d. per ton, or £4 7s 9d. above the average price for July-December, 1914. The average price for the year is therefore £14 7s. 7d. per ton, or £3 0s. 6d. above the average for 1914; and it is necessary to go back as far as 1884 to find a higher average price in any year—viz., £14 9s. 3d. per ton. Such a result can only be attributed to the accident of war, whereby Germany, who had become a very serious competitor with the United Kingdom in the world market, has been "out of the running." The high average price has, moreover, it is pointed out, to be very substantially discounted to cover the inflated cost of acid, coal, labour, &c. But, when full allowance is made to cover the increased cost of manufacturing, the net result must be considered to be highly satisfactory, though not as satisfactory as the result in 1912, when the cost of manufacturing was about normal, but the output was largely affected by strikes.

Figures Regarding Output.

The output in the United Kingdom in 1914 proved to be 426,000 tons, or a decrease of 6000 tons on 1913; there having been a decrease of 6000 tons from gas-works and of 4000 tons from iron-works, against an increase of 4000 tons from carbonizing, &c., works. The reviewers find it impossible to estimate with much confidence the output during the past year; there being scarcely a single industrial concern or a gas-works which has not been affected for better or worse by the war conditions which have existed. From figures and opinions furnished to them, however, they think it well to give the conclusions at which they have arrived. The production of ammonia, calculated into sulphate (including that used in the manufacture of ammonia soda, munitions, and for other chemical purposes), from all sources in the United Kingdom during 1915, they estimate, with all reserve, at 423,000 tons, divided up as follows:

	Tons.
Gas-works	173,000
Iron ,,	16,000
Shale ,,	58,000
Coke and carbonizing works and producer gas	176,000
	423,000

Of this total, it is estimated that England contributed 302,000 tons, Scotland 118,000 tons, and Ireland 3000 tons. The production in tons of the previous four years was:

	1914.	1913.	1912.	1911.
Gas-works	176,000	182,000	172,000	169,000
Iron ,,	16,000	20,000	17,000	20,000
Shale ,,	63,000	63,000	62,000	61,000
Coke and carbonizing and producer gas	171,000	167,000	137,000	135,000
Totals	426,000	432,000	388,000	385,000

Messrs. Bradbury and Hirsch's estimate of production in the United Kingdom in 1914 was 5000 tons under the mark; the shrinkage in the output from carbonizing, &c., works during the first half of the year having been more than balanced by the larger output in the second half. They are satisfied that their estimate of stocks at the end of the year was substantially correct, and that the increased output disappeared in home consumption—partly, if not mainly, in the production of munitions. On this assumption, the account for the year 1915 will stand as follows:

	Tons.
Stocks brought forward from 1914	25,000
Production in 1915	423,000
	448,000
Exports during 1915	294,000
Home consumption (for all purposes) in 1915	128,000
Stocks to carry forward into 1916	26,000
	448,000

Market Prospects.

Production.

The production of ammonia calculated into sulphate in the United States during 1915 is estimated by the American Coal Products Company to have been 212,000 tons—an increase of 17,000 tons upon the actual output in 1914. It is, further, estimated that something like 79 per cent. of the 1915 output has been from bye-product coke-ovens; and in view of the keen demand for coke and for the bye-products, it seems certain, say Messrs. Bradbury and Hirsch, that a further substantial increase in the output of sulphate of ammonia in the United States must be counted upon in 1916. For the same and for other reasons, they think that there will be an increased output in the United Kingdom in 1916; but it is quite impossible to estimate what it may amount to. There will no doubt be some increase in production in Japan and other countries; but as this will not come on to the world market excepting to slightly limit demand upon the United Kingdom, they think they may proceed to the consideration of the outlook from the point of view of the United Kingdom supply alone, as they did at the end of 1914—more than the entire output in the United States being required for home consumption.

What, then, it is asked, are the chances of the market over the coming season? Replying to this question, the reviewers say it may help to clearness of vision if it is remembered that the shrinkage in shipments was about 36,000 tons to Japan and the United States, in January-April last, compared with January-April, 1914, and that this shrinkage was practically balanced by the increase in shipments to Holland, Java, and Sweden over the same period. Seeing they are of opinion that the course of the market may eventually depend upon shipments to the above-named countries over the next four months, more than upon anything else—excepting perhaps home demand for munitions—they think it well to discuss the chances of larger or smaller shipments in some detail. Though there was a shrinkage of about 36,000 tons in the shipments to Japan and the United States in January-April last, these two countries took between them nearly 16,000 tons during that period. So far as can be judged, they are not likely to take more than half as much over the next four months. Against the increase of 36,000 tons in the shipments to Holland, Java, and Sweden in January-April last, it may safely be assumed that Sweden will get none—against rather less than 5000 tons last season. The quantity permitted to be supplied to Holland will be determined by the War Trade Department; and, inasmuch as the brake was applied rather sharply when 21,155 tons had been reached at the end of March last, they are of opinion that it may also be assumed that the intention is to reduce the limit for the next three or four months. In dealing with the case of Java, a longer period than the four months from January to April should be taken for comparison, because Java is further away from the market, and has quite obviously been anticipating requirements. Shipments from July, 1914, to April, 1915, when Germany was not in competition, amounted to 48,035 tons, against 23,799 tons for July, 1913, to April, 1914, when Germany was competing—an increase of 24,236 tons. Against 48,035 tons which Java took from July, 1914, to April, 1915, she from July up to the end of December took no less than 58,814 tons—that is to say, 10,779 tons more than she took altogether from July, 1914, to April, 1915. In view of this, is Java over January-April, 1916, likely to require very much of the 20,491 ton. which she took during January-April, 1915? The firm think not, after making every allowance for the stimulant of the famine price of sugars Spain will take larger quantities no doubt, as will also the West Indies and other sugar-growing countries, but not more than enough to compensate for the shrinkage anticipated in the Japanese and United States demand.

Prices.

From the point of view, therefore, of probable external demand over the coming season, Messrs. Bradbury and Hirsch do not see that any higher level of prices is justified. One must, they say, consider the home situation to understand the rapid upward movement in prices which has been going on since the beginning of October. The demand for ammonia for munition purposes, which has been steadily increasing during the past nine months, is a new factor in the case. It is, of course, impossible to get any exact estimate of what this demand now amounts to per month; but in coming months it is certain that it will be out of all proportion to any increased output there may be. Then, as already pointed out, pressure has been brought to bear upon producers to reserve a proportion of their output for direct sale to farmers, at preferential prices, in order to induce a larger home consumption. Whether the scheme will achieve the object intended, the firm are inclined to doubt, because, as hitherto, this same trade has been provided for by manure manufacturers and local distributors by purchases and preparation made in advance. The farmers are therefore being catered for from two sides, which are bound to come into conflict; and it does not seem likely that manure manufacturers and local distributors will let the business slip through their fingers—especially if this involves the carrying of their stocks forward to another season. However that may be, there can be no question that the reservation itself on the top of actual requirements for munition purposes made a decided impression upon the minds of buyers, both at home and abroad, the effect of which has been seen in the shape of exceptionally heavy purchases the past three months for delivery ahead; it being realized that requirements for both purposes would be a first call on the supply.

There has, they proceed to point out, been another reason for this heavy purchasing. Last season's experience has not been lost upon buyers abroad. If freight room was insufficient over the vital months last spring, it is likely to be still more limited in 1916. If freight rates had advanced last spring, they are on a still higher level now; and they have probably not yet reached the ultimate. It is not surprising, therefore, that buyers abroad should wish to avoid the losses and the inconveniences to which they were subjected last season, and be anxious to anticipate their prospective requirements by a month or more. This is exactly what they have been doing; and this action has no doubt contributed materially to the recent advance in prices. So far as this policy has succeeded, it will follow that requirements will be smaller later on; but this cannot in the meantime affect the situation which has been created. The question of the supply of sulphuric acid will become more acute as the demand for munition purposes increases, and there must in consequence be some shrinkage in the output of sulphate of ammonia. But, inasmuch as the Munitions Department can make use of concentrated liquor in place of sulphate of ammonia, the shrinkage in the actual output of sulphate does not require to be allowed for in this calculation. It has been taken account of in requirements of ammonia for munition purposes.

The reviewers do not see, in the actual circumstances, reason to doubt the stability of the market for some way ahead at least. But if, as they suggest, buyers have, on the advancing market, bought more heavily and for earlier delivery than usual, they are of opinion that there may possibly be a set-back in prices when the summer months are reached. The extent of the demand for munition purposes will probably settle the latter point.

The concluding portion of the review is, as usual, devoted to an account of the market during the different months of the year; and there is also given the following list of

Average Prices of Sulphate since 1867.

Figures quoted at the end of the review show the following to be the average prices per ton since 1867 of good grey 24 per cent. sulphate of ammonia f.o.b. Hull: 1867, £11 10s. 1868, £14 10s. 1869, £15 15s. 1870, £16. 1871, £19. 1872, £21. 1873, £18 3s. 9d. 1874, £17 2s. 6d.

1875, £18 10s. 1876, £18 12s. 6d. 1877, £19 16s. 3d. 1878, £20 5s. 1879, £18 8s. 9d. 1880, £19. 1881, £20 4s. 6d. 1882, £20 8s. 6d. 1883, £16 11s. 1884, £14 9s. 3d. 1885. £11 9s. 1d. 1886, £11 3s. 7d. 1887, £11 17s. 8d. 1888, £11 18s. 1889, £12 1s. 4d. 1890, £11 9s. 1891, £10 15s. 5d. 1892, £10 1s. 10d. 1893, £12 11s. 4d. 1894, £13 3s. 8d. 1895, £9 15s. 4d. 1896, £7 18s. 0¼d. 1897, £7 18s. 5d. 1898, £9 9s. 7d. 1899, £11 5s. 10d. 1900, £11 2s. 1901, £10 11s. 4d. 1902, £11 16s. 3d. 1903, £12 9s. 2d. 1904, £12 3s. 8d. 1905, £12 10s. 9d. 1906, £12 0s. 9d. 1907, £11 15s. 8d. 1908, £11 12s. 1909, £11 5s. 1910, £12 3s. 2d. 1911, £13 15s. 3d. 1912, £14 7s. 9d. 1913, £13 7s. 8d. 1914, £11 7s. 1d. 1915, £14 8s. 1d.

PUBLIC LIGHTING RESTRICTIONS.

The Question of Allowances to Local Authorities.

Finding that a number of members are still having disputes with their local authorities as to what allowance should be made in respect of diminished lighting in war-time, the British Commercial Gas Association reproduce in the January issue of their "Bulletin" extracts from a statement on the subject submitted by the Gas Light and Coke Company to a Government Department, and accepted by them as satisfactory. At the same time, it is pointed out that the arguments advanced obviously only apply where long-period contracts for inclusive service are in force, and no increase has been made in charges since the outbreak of war. The following are the extracts referred to.

The Company would have been justified, under their contracts for public lighting, in complying with the requirements of the Admiralty by completely obscuring the glass of the lanterns, and leaving the gas burning inside. [This has been done in some districts outside the Company's area of supply.] No question of allowance would then have arisen, as the Company would have been fulfilling their contracts, and also complying with the requirements of the Admiralty. It appeared, however, to the Company that this would be a gross waste of gas; and therefore, without prejudice to their contract rights, they agreed to extinguish those lamps which the Admiralty had directed should no longer give light.

The Company might then have taken the point that their contracts had been suspended by the outbreak of war and the subsequent reduction of the number of lamps in use, and have asked for a material revision in the prices charged for lamps in lighting, as the cost of gas manufacture has substantially increased (causing an increase in price of 6d. per 1000 cubic feet to the public); the salaries and wages of the staff and workmen employed upon public light work have had to be substantially increased to meet the higher cost of living; the cost of repairing and re-glazing the lamps has been doubled, owing to the scarcity, and consequent very high price, of glass and the increased cost of labour for this work; and the cost of all burner-parts and mantles has been steadily rising since the commencement of hostilities. Moreover, there is every reason to anticipate that, as a consequence of the war, the engagements recently made by the Company with the Commissioners of Works in regard to public lighting, for a period of ten years, will be far less favourable to the Company than was anticipated when the prices embodied in those engagements were quoted. The Company, however, have not asked that under these new conditions the prices they quoted for the ten years' agreement should be revised, either in respect of the period of the war or subsequently; and they therefore submit that they should not be called upon to make any allowance in respect of the lamps out of lighting (under circumstances outside their control) greater than the amount that they actually save as a consequence of not supplying gas to the lamps in question.

That saving only represents a very small proportion of the agreed charge per lamp when in lighting, because this charge includes, in addition to the cost of gas used, the repayment of the cost of new lamps, salaries, and wages of inspectors, foremen, and lamplighters, and the repair and maintenance of burners, lamps, and columns. In regard to all the charges other than gas, the Company effect no saving, as the increased costs of labour and material already specified more than counterbalance any small saving effected in labour employed and material used, owing to certain lamps not being in lighting. In regard to the saving effected through the non-supply of gas, this does not amount to more than 6d. per 1000 cubic feet, because our charges for gas supplied are largely comprised by capital, distribution, and administration charges that cannot be diminished when there is a sudden reduction in output. All that can be saved is the cost of the actual coal not used (less the residuals not produced), and a part of the wages paid for manufacture and purification.

From "Field's Analysis" for the year 1913, it will be seen that the net cost of coal in the case of this Company amounted to 4·45d. per 1000 cubic feet of gas sold; while the manufacturing and purifying wages amounted to 1·89d. and 0·33d. per 1000 cubic feet respectively. Not more than one-half of the last two items would be saved in the event of gas not being made; and we therefore get a total saving of 5·56d. per 1000 cubic feet. We have taken this at a round figure of 6d. This is the basis upon which we have made allowances to other lighting authorities with whom we have similar contracts to those into which we have recently entered with the Office of Works; and our allowances have, after similar explanations, been accepted as equitable by all those authorities—including the City of London, the City of Westminster, the Boroughs of Chelsea, Finsbury, Hackney, Holborn, Islington, and Stoke Newington, and the District Councils of Chingford, Hendon, Loughton, Wanstead, Willesden, and Woodford.

Salford War Bonuses Approved.—According to the printed minutes of the Salford Gas Committee, approved at the last meeting of the Town Council, the following bonuses have been granted to certain grades of employees: Labourers, 1s. per week; shiftmen, 2d. per shift; foremen (other than foremen of tradesmen), 2s. per week.

GAS AND ELECTRIC LIGHT COMPANIES UNDER ONE MANAGEMENT.

At the Ninth Annual Convention of the American Illuminating Engineering Society, held at Washington last September—the full report of which is contained in the issue of their "Transactions" received the early part of this month—a paper was read by Messrs. A. B. Spaulding and N. H. Potter, entitled "How can Gas and Electric Companies under One Management render the Best Light Service." It is prefaced by the following synopsis: This paper treats, from the commercial standpoint only, the subject of service to the customer by gas and electric companies under one management. It emphasizes the importance of service to the customer, and outlines the question of service from a practical standpoint. In discussing the selling force necessary for the proper handling of lighting business, the authors recommend the employment of specialists on gas illumination and specialists on electric illumination. The education of the salesmen is considered, and a successful local educational course is outlined. The education of the customer is discussed from the standpoints of the manufacturer of appliances and the lighting company. The relation between the representative and the customer is of special importance, and particular stress is laid on the matter of the maintenance of lighting units, which maintenance is in reality the "keynote of service."

One of the important subjects to-day among gas and electric companies is "How can the best service be given?" The engineering phases of this question have received marked attention, and the improvement in design and operation of gas and electric plants has increased the confidence of the public in the efficiency of these plants. This paper deals with the rendering of service after the product is delivered, or beyond the meter. There are differences of opinion as to how this can best be done.

Among the trio of products of gas and electric companies—light, heat, and power—light has always received the first place. Upon the selling of this product depended the initial success of all gas and electric companies; and the early history of both industries is bound up inseparably with the development of their lighting business.

There has been a radical change in the methods and personnel of the selling force. Heretofore gas and electric energy were the points of discussion with the consumer; but now illumination is the topic. Instead of so many cubic feet of gas, or watts of energy, illumination is being sold. On account of this advancement the illuminating engineer has developed; and the Illuminating Engineering Society is an outcome of the desire of gas and electric companies and manufacturers to render the public a service by united effort toward improved illumination.

The present estimate of the worth of any man must be, "How much does he produce?" and if any representative, no matter what his printed title may be, does not produce, he is not efficient.

Selling and service should be synonymous, and service has various phases. In order to render it intelligently it is essential, first, that the representative be capable of laying out and supervising a lighting installation; and, second, that the consumer be educated to appreciate the difference between proper and improper lighting, insofar as the value of proper lighting to his business is concerned.

Service does not necessarily mean the reduction of bills; it may, and often does, result in an increase in the amount of business with customers. Proper illumination is desired, and must be the primary factor in the discussion of cost, not only of electricity and gas supplied, but of fixtures and first installation. Service, therefore, means the providing of the illumination best suited to each customer at minimum cost. Both the representative of lighting companies and the public must be educated to the value, use, and maintenance of a lighting installation.

Gas and Electric Specialists on the Sale of Illumination.

The writers believe that with gas and electric companies under one management specialists on gas illumination and specialists on electric illumination are productive of the best results—particularly as regards service to the customer. This method is, in reality, intensive selling; and each man becomes an expert in either gas or electric illumination. Both men are selling the same thing—viz., illumination; and, unconsciously perhaps, each man picks out the most likely prospects.

It would seem that there is no good reason for a gas or electric company under one management adopting a policy which encourages only one source of supply. The duty of such a company is not to predetermine what source to sell, but to give the customer the benefit of the best advice, and leave to him the decision. That two sources are better than one is certain where gas and electric units are installed for general illumination. The units should harmonize with each other and with their surroundings. The only question which might influence the installation of a single source would be its adaptability.

The argument has been advanced that by having one man to sell both gas and electric illumination, the selling force could be cut in half. This is not true, if the business is to be taken care of properly. It has been contended that the consumer is confused by having two men advising different sources of supply. This may be true where companies are under separate management, and competition dictates a policy of "Get business anyway—but get it," rather than a policy of real service to the consumer. With a company under one management, the consumer is not confused by having information on both gas and electric illumination from different men. The customer should be credited with common sense and have the privilege of choice. By having both sides advanced to him by experts, he is able to consider economy, convenience, safety, &c., and in the end be sure that he is getting the method of illumination best suited to his needs.

Summing up, we find that separate gas and electric lighting representatives are in the end no more expensive than combination representatives. There is absolutely no question that this separation does stimulate the trade in a healthy manner. Each salesman becomes more proficient in the art of gas or electric illumination as the case may be. He has co-operative competition and will necessarily have to watch his installations more closely. He is also forced to make proper installations and to render proper service after installation is made. Otherwise he is likely to have "lost business" charged up against him, and he keeps in closer touch with improvements in his particular line.

A man selling both gas and electricity is too prone to follow the path of least resistance, and to think: "If I don't sell gas, I will sell electricity," with the result that a desire for better illumination is not created, and therefore the best service is not given.

Education of Salesmen.

Lighting representatives should have a good appearance, personality, and selling ability, together with a knowledge of the principles of illumination. The salesman should make a general survey of his territory and become familiar with its conditions. He should make periodical tours after dark in the store section. He can then pick out the improperly lighted stores, and by one night's work of this sort obtain sufficient leads to keep him busy for several days. The writers know of several instances where salesmen living out of town had never seen their territory illuminated. After making night inspections, and following up leads thus obtained, the volume of store business from their particular sections showed a marked increase, and improved installations also resulted.

The representative should visit other districts than his own, and, where possible, other cities and towns—thus acquainting himself with conditions, perhaps different from those in his territory, which will enable him to handle more successfully new and similar problems as they arise.

The lighting representative should, if he expects to become more valuable to his company, do everything in his power to increase his knowledge of illumination and other branches of the business. This can be brought about by his becoming a member of the Illuminating Engineering Society, National Electric Light Association, and National Commercial Gas Association, through which he obtains, at first hand, knowledge of all advancements in the art of illumination as well as other subjects—particularly so if he take advantage of correspondence courses. If he be fortunate enough to have a local section of any of these Associations in his vicinity, he will derive great benefits by attending all its meetings and taking an active part in the discussions. In addition, he will become acquainted with other men in the same line, receive the benefits of their personal knowledge and experience, and be able to reciprocate.

There are other means at hand of increasing one's knowledge and keeping abreast of the times—viz., reading periodicals dealing with all branches of illumination, and the advertising literature sent out by manufacturers. It contains an education in itself. This literature should be studied, not merely read; for here is a fruitful field of knowledge. Up-to-date data can be obtained by having one's name placed on the mailing lists of manufacturers.

The sales manager in charge of these men should hold regular meetings for the discussion of illuminating problems. Arrangements should be made for visits to places like the testing laboratories and various fixture and lamp works. When some particularly fine installation has been made in the vicinity, a party should be made up to inspect and discuss it when it is lighted.

The company itself has a duty to perform in the education of its representatives. It should encourage the men to study and show that their efforts are appreciated.

The Public Service Gas Company and the Public Service Electric Company of New Jersey have given courses to develop the desire for further knowledge on the part of their men. The following course has been given by the latter Company: (1) "The Central Station Salesman: His Duties, Troubles, and Needs." (2) "Lamps: Their Manufacture and Characteristics. (Lecture by the representative of a lamp company, and visit to a factory.) (3) "Light: Its Production and Properties. Some Laws of Light." (4) "Measurement of Light and Illumination." (Visit to testing laboratories.) (5) "Reflectors, Shades, and Diffusing Globes: Their Use and Abuse." (6) "Direct and Semi-Indirect Illumination." (7) "Location of Units: General Consideration." (8) "Residence Lighting." (9) "Store Lighting." (10) "Industrial Lighting." (11) "Electrical Advertising." (12) "K.W.H. Sales and New Business." (13) "Wiring." (By a contractor.) (14) "Review."

Education of the Consumer.

The main object of a storekeeper, for instance, is to sell merchandise. He has no desire to become an illuminating engineer; but he is desirous of having his store and windows properly illuminated—provided, of course, he is an up-to-date merchant. In the event of his being behind the times (and there are many of the kind—in fact, they are the ones who make up the best list of prospects), he should be taught that a properly-lighted store and window are absolutely necessary for success in selling merchandise.

The desire to have a properly-lighted window, store, factory, or home lies dormant in every man; and under stimulus he will unconsciously start a course of self-education by asking questions and observing other installations and perhaps reading.

The company should send advertising literature acquainting him with the proper method of using lighting units. For obvious reasons, this literature should be absolutely non-technical. It should be attractive in appearance, and so written that it will hold the attention from cover to cover.

The manufacturer's representative should present the subject of illumination first, and, secondly, the wares he is selling. The architect, builder, electrician, and gas-fitter should be educated by both the company and the manufacturer, in order that they may in turn do their part toward the education of the prospective customer.

With these three different sources of information for the customer properly co-ordinated, there would be little or no reason for the absence of good lighting installations.

Relation of Representative and Customer.

As has been stated, the first consideration in this relation is the

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impressing on the consumer the value of proper illumination. Poor installations have been made in every town; and one of the present difficulties is to have the customer realize the importance of a good installation.

If the manufacturers of lamps and accessories were to deal entirely through the gas and electric company whose sole idea is proper illumination, or at least submit for the approval of these companies the unit or accessory which is to be installed for a customer, relations with the consumer would be much improved.

Cheap and inefficient gas and electric units have caused the gas and electric companies much trouble. Such units are often sold with an argument to the effect that the gas or electric company is robbing the consumer, and will not sell such units because they reduce the company's revenue. On account of such conflicting suggestions to the customer, it has been found advisable to demonstrate the correctness of recommendations made. The Public Service Electric Company has been using for some time very successfully window demonstration sets, which are usually allowed to remain about a week, and convince customers of their value and lead to the installation of permanent outfits. Factory lighting may be handled in the same way. Demonstrations of either gas or electric lighting have been in many cases the closing arguments for the sale of better lighting.

After the installation is laid out, it is necessary that the representative should closely follow the development in the work, to see that the suggestions of the electrician or plumber are not such as to spoil the desired results. It often occurs that the customer accepting advice on changes in position of outlets and accessories secures an incorrect installation, and blames the representative for whatever unsatisfactory result may ensue.

The representative's responsibility does not end with the demonstration. It is his duty to lay out the proper units (supervising their installation) and see that prompt service is rendered. At this point the real service in lighting installations begins. Once connected to the company's supply, service to the customer never ends, and that all-important question of maintenance begins.

In the case of electric lighting, maintenance is more or less a matter of education. The customer should be taught first that electric lamps have a useful life, and that after a certain period it is economy to throw away old and purchase new lamps. Secondly, reflectors decrease in efficiency with the accumulation of dust, and, like the plate-glass window in the store, must be cleaned periodically.

The customer usually promises to attend to these details, which are in reality part of his regular house cleaning; but the drop in efficiency, or the loss in illumination, is by such small steps that it is never noticeable from day to day, and the customer, being intent on selling goods, gives little or no attention to the absolute importance of maintenance questions.

The lighting salesman may continue rendering service by calling attention to any blackened lamps, dirty reflectors, &c. By stating to the customer that this is his (the salesman's) installation, that he is proud of it, but that it cannot come up to his guarantee unless properly cared for, the customer is usually awakened to his responsibility in the matter; and the habit of periodic inspection and cleaning is formed.

In the case of a gas installation, maintenance is also a very important matter. Thoughtlessness or carelessness is the reason for depreciation in lighting value. Again, the daily change or drop in efficiency is so small as to be unnoticeable. Many customers through not having time, or not appreciating this drop in efficiency, continue using old or broken mantles, with the result that very poor service is obtained from the unit.

Gas companies have been trying for years to educate customers to give proper attention to their lighting units; but in many cases it is almost a hopeless task, with the result that in many instances companies have launched maintenance departments to do for the customer what he does not seem to care to do for himself. Probably the day is not far off when gas companies will have to maintain all customers' lighting installations, in order to insure proper illumination.

At this point the writers desire to mention a system of residence maintenance service by which customers receive periodic inspections of all lighting units. This service includes cleaning of glassware and adjustment of burners without any charge. The men engaged in this work also carry samples of the latest types of lamps, and a full line of repair parts and accessories. If new material is sold to replace that which is broken, no charge is made other than the regular selling price of such material. By this plan the company is enabled to attend to all complaints received before 3 p.m. the same day. This plan is being tried by the Public Service Gas Company in one city in New Jersey with such good results that in a very short time it is expected that the sale of repair parts and additional units alone will make this department self-sustaining—not to mention the increased satisfaction on the part of the consumer nor the added consumption derived by having more units in good working order. This department is productive of many sales, and materially strengthens the selling organization of the company.

It is the opinion of the writers that, in order that a gas and electric company under one management may give the best lighting service, separate representatives who are specialists in the application of each lighting source should be employed. These representatives should be encouraged to keep in touch with the science of illuminating engineering and the most advanced thought in modern salesmanship. The company should lead the customer to an intelligent appreciation of proper illumination, and by the adoption of a maintenance service should make him feel that the company is genuinely interested in his continued satisfaction.

Reduction in Price at Redcar.—The Directors of the Redcar, Coatham, Marske, and Saltburn Gas Company announce a reduction of 2d. per 1000 cubic feet to all consumers as from Jan. 1.

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NORTHWICH GAS PURCHASE PROPOSAL.

A ratepayers' meeting was held at Northwich last week to consider the promotion by the Council of a Bill [*ante*, p. 76] to provide for the transfer of the undertaking of the Gas Company to the Council.

The CLERK (Mr. J. A. Cowley) explained that the Bill was the outcome of the Company's Bill of last session, in which they obtained a clause authorizing the acquisition of the undertaking by the Council. Within six months after the passing of the Act, the Council were to give the Company notice of their intention to purchase. The Council had decided, having regard to the expert advice received, to ask the electors for their sanction to proceed with the Bill, but had authorized the Chairman to give an undertaking that the Bill would only be proceeded with if the Council could agree with the Directors of the Company upon a price to be paid by the Council for the concern, when such agreement could be embodied as part of the Bill. They did not consider that arbitration proceedings should be resorted to. It was quite possible to arrive at an agreement before the Bill was introduced into Parliament; for it had been done on many occasions.

Mr. J. WORSLEY (the Chairman of the Council) then proposed a resolution in favour of the Bill.

Mr. J. O. BRANDRITH, in seconding, said he was glad to think they had decided to purchase by agreement, and not go to arbitration. What they were doing now should have been done years ago; but, though late in the day, he asked the ratepayers to assist the Council to take over the undertaking as early as possible.

The CLERK, in reply to questions, stated that in the Gas Company there were 1600 fully-paid ordinary shares of £15 each, and 2585 fully-paid preference shares of £10 each, which, with £349 premium, made £49,999, in addition to which there were mortgages for £10,900—a total capital of £60,899. The Council's opposition to the Company's Bill did not go before the Parliamentary Committee last year. Had this been done, the expert evidence they would have been able to put before the Committee would have satisfied anyone that it was possible to utilize the present site for all purposes for which the Council required it.

The CHAIRMAN added that, personally, he was strongly opposed to arbitration. It meant thousands for one side or the other to pay. It was a thing to be avoided by every means; and the Council had decided to avoid it. The Council hoped to be able to come to terms with the Gas Company; but it was absolutely necessary, in order to enable them to negotiate with the Directors, who were reasonable men, that they should get the consent of the electors.

Mr. SUTHERST said he considered the financial aspect of the town was such that it was too serious an undertaking for them to accept the proposal. In arriving at a valuation, they would not only have to take the nominal value of the shares, but the market value. The £15 ordinary shares had changed hands at £30 to £32; and the lowest price realized was £25. If they took the ordinary shares at £25, and the preference at £11, this roughly amounted to £75,000. Then they were seeking powers to borrow another £32,000, which would bring the total price up to £100,000.

Mr. WILKINSON said purchase by agreement was the only possible way. They were a small town, and ought to be able to settle the matter amicably when experts like Mr. J. G. Newbigging and Mr. Isaac Carr got together. The £30,000 referred to was not to be spent on the existing works, but on improvements. They expected to get a better return, and increase the output at less cost.

The CLERK said Mr. Carr (who was the Consulting Engineer and expert adviser to the Council) was entirely with the Council. Arbitration proceedings would pay Mr. Carr; but, against his own interests, he advised the course which the Council proposed to adopt.

Mr. ISAAC CARR said it was the duty of every gas company to maintain the works as new out of revenue; and if the Gas Company here had done their duty, as they naturally would do, the cost of maintaining the works and keeping them up had been paid by the gas consumers as the years rolled by.

On a vote being taken, about sixty voted in favour of the resolution, and there were two against. Some fifty persons abstained from voting.

Spirited Protest by the Gas Company.

In the light of a letter issued by Mr. P. S. Welbourn (the Secretary of the Company) since the foregoing report was penned, it may now be permissible to state that during Mr. Sutherst's speech he alluded to the Northwich Gas-Works as being "a worn-out concern." Later he made use of the remark that the concern "had been in existence forty years, and things were getting rather worn out." Mr. Wilkinson, who followed, deprecated anyone speaking disparagingly of the condition of the Company; and the Clerk of the Council asked whether the speaker suggested that the works were old and derelict. Mr. Sutherst replied that he "did not say the concern was derelict, but, naturally, after forty years there must be a tremendous amount of wear and tear." Other remarks were made to the effect that the Directors of the Company had not enlarged and remodelled their works to cope with the increased demands for gas.

Mr. Welbourn points out that during the last eight years the following new works schemes have been sanctioned by the Directors and carried into effect: Extension to retort-house; new time office; sulphate house and fitting shop, workshop, washer-scrubber, station meter; liquor and tar tanks; governors; purchase of property for extensions; redemptions of land tax; new mains and services; new gasholder, and repairs to gasholder; the total (approximate) cost being £16,407—not including ordinary wear and tear of works and mains.

◆

Gas Explosion at Folkestone.—By a gas explosion at a house in Cheriton Avenue, Folkestone, which occurred on her entering a room and igniting a match, a domestic servant was somewhat severely burned, and was removed to hospital. The contents of the room were much damaged. It is supposed the leakage was from the pendant.

Progress "as usual"

¶ Notwithstanding the Works dislocation incidental to recruiting and other circumstances connected with the War, The Davis Gas Stove Co., Ltd., continue to make solid progress.

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COKE AS A BOILER FUEL.

An Expert's View.

Last Friday's issue of the "Electrical Review" contained an article on this subject from the pen of Mr. E. W. L. Nicol, of the London Coke Sales Committee, regarding some statements made by our contemporary in their number for Dec. 31.

Mr. Nicol regards the matter as of very considerable current interest, in view of the present high cost of coal and shortage of supplies from the usual sources. On the other hand, as he points out, there are the plentiful supplies of coke available, more particularly in districts so affected.

At many of the more important gas-works, the article continues, during the present period of maximum demand for gas, the output of coke is to some extent controlled by increasing or decreasing the manufacture of carburetted water gas in its relative proportions to that of coal gas, as carburetted water-gas plant is a consumer (not a producer) of coke. The residuals from which the much-required, high explosive bye-products are derived are, however, obtained only in the process of coal-gas manufacture. This fact, coupled with the curtailment of export and shortage of labour, necessitates fresh outlets being obtained in directions which do not entail the employment of extra labour other than grading or loading into trucks or barges.

The method of adapting a chain-grate to burn coke as illustrated in the December article is simple, and, no doubt, effective, Mr. Nicol remarks; but the air leakage through the improvised grate bars in the feed-hopper would result in relatively poor thermal efficiency and low evaporation being obtained. He then describes how chain-grates working in this country under boilers of 20,000 lbs. per hour capacity, have been modified to burn coke without material reduction in capacity or efficiency. The ignition arch has been retained, and satisfactory ignition is effected by admitting a thin layer of coal slack with the coke, which is graded to convenient size. With this method, air leakage into the furnace is eliminated, and normal capacity and efficiency are obtained.

To break and grade coke to suitable size, for either the coking or sprinkler-type of stokers, should not be a matter of very great difficulty. An ordinary coke-cutter, absorbing about 4 or 5 H.P., will deal effectively with 30 tons per hour at a very insignificant cost.

As to the relative cost of coal and coke as boiler fuels, due regard must be had to quantities, locality, and delivery facilities. Taking the River Thames, prices for washed slacks having an average of about 12,500 B.Th.U. have lately been about 30s. per ton, including delivery, while coke of equal calorific value, and of considerably greater value to the user, may be obtained in the required quantities at considerably less cost. Having these figures in mind, and the fact that the normal surplus of coke exported, according to a recent Home Office report, is about 2 million tons annually, there should be little hesitation in making, not temporary and improvised, but permanent provision to utilize these sources of supply. The surplus normally available on the Thames is probably from 400,000 to 500,000 tons of coke and coke-breeze annually.

From the national point of view, which is one of considerable and growing importance, every ton of coke made from sea-borne coal and used in towns and cities in place of rail-borne steam coal will relieve the congestion on our railways to this extent; while the equivalent, in the case of Welsh coal, which is less suitable for carbonization, would be released for export.

In considering the question of substituting coke for coal fuel in a power station handicapped by being laid out and equipped to use a uniform class of coal only, the problems of storage and capacity of machine stokers and boilers naturally arise. The reserve stocks of coal usually carried by gas authorities are necessarily considerable, and, to a coke user buying under contract, would, of course, be available. This consideration should to some extent offset the disadvantage of the relatively greater bulk of coke. At normal rates of combustion, and with equal draught, the steaming capacity of a hand-fired boiler will be reduced by 15 to 20 per cent. by substituting coke for coal of similar calorific value.

There are, of course, ready means of supplementing an inadequate draught, but in the case of stokers of the coking type the problem is more complicated. To start from the beginning, there are obvious bargaining and other advantages to be realized by installing a stoker that will equally well handle coal, coke, coke breeze, and possibly anthracite; and it is a matter for considerable satisfaction that such a stoker has been developed and is now receiving the patronage it deserves in this country.

While on this subject it may be profitable to anticipate the trend of the findings of the several committees appointed to deal with the question of fuel conservation and smoke abatement. The national requirements in high-explosive material and other bye-products of coal carbonization will, no doubt, be held to be paramount. The future tendency will therefore probably be to discourage shipment of coking coals, and gradually to limit export to anthracitic non-coking and other coals less suitable for carbonization. The resulting output of coke will necessitate improved means for its economic combustion under steam-boilers, in gas-producers, and for domestic use.

* * *

Lecturing on the "Power of Coal Gas" before the members of the Middlesbrough and District Association of Foremen Engineers and Chief Draughtsmen, last Saturday week, Mr. Matt. Dunn, of Stockton-on-Tees, after referring to the advantages of using gas, spoke of the part which gas-works are playing in the manufacture of munitions of war. He pointed out that gas-works are responsible for the highest explosives known to-day. Coal gas was a thing which could not be disregarded; and when the war was over, it would have established a record which would be handed down, much to the advantage of gas undertakings generally.

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REPORT ON THE SOUTHPORT GAS-WORKS.

Mr. John Bond's Annual Statement.

The annual report of Mr. John Bond, the Engineer and Manager of the Southport Corporation Gas Department, was presented to the Town Council on Tuesday last, though it is for the year ended March 31, 1915.

Mr. Bond points out that there was an increase in the consumption of gas amounting to 60,319,000 cubic feet, which is 10·8 per cent. above the previous year's figures. This abnormal increase was, says the report, mainly due to the large number of troops billeted in Southport during last winter. The prepayment system of gas supply now amounts to 15·99 per cent. of the whole consumption, and shows an increase of 13·33 per cent. over the preceding year's figures. The average price received for all gas supplied amounted to 2s. 5·18d. per 1000 cubic feet. The total is 0·03d. per 1000 cubic feet over the previous year. The total capital expended per 1000 cubic feet gas sold was 9s. 11·10d., as compared with 10s. 11·97d. The capital outstanding per 1000 cubic feet of gas sold was 5s. 7·68d., compared with 6s. 5·53d. for 1914.

The gross profits for the year amounted to £26,634; and after paying £13,581 towards the interest and sinking fund, there remained a net profit of £13,053. It was proposed by the Town Council that £13,000 should go towards the relief of the rates, which left a balance of £53 to be carried forward. The capital account (total amount expended) now stood at £307,003; and the gas-works debt, after deducting payments through sinking fund, at £174,458.

The gas-making material used was as follows: Coal, 51,850 tons (increase, 157 tons); oil, 618 tons (increase, 409 tons); coke, 1837 tons (increase, 1356 tons). The maximum and minimum makes of gas during 24 hours were 2,823,000 cubic feet and 951,000 cubic feet respectively. The percentage of unaccounted-for gas was 4·54; and the make of gas per ton of material used was 11,814 cubic feet. Of the total of 658,098,000 feet of gas made, 45,555,000 cubic feet was carburetted water gas. The total number of meters in use at the end of the year was 20,142, which was an increase of 715 on the previous year. The gas-cookers on simple hire and hire-purchase numbered 9852, compared with 9302 a year before.

ROCHDALE GAS-WORKERS' WAGES.

Reference was made in the last issue of the "JOURNAL" [p. 108] to the demands of the National Union of Gas Workers and General Labourers for increased wages at Rochdale to about 150 men (including meter inspectors), and for various alterations in the number of hours worked. It was stated that the Gas Committee had granted certain concessions which represented an increase to the wages bill of, approximately, £780 a year (of which £570 was already being paid in war bonus); leaving the net addition £210.

The following list shows the class of workman affected.

Stokers	5s. 6d.	to 5s. 9d.	per eight-hour shift.
Boiler firemen	4s. 8d.	,, 5s.	,, ,, ,,
Carburetted water gas operator	5s. 6d.	,, 5s. 9d.	,, ,, ,,
Carburetted water gas assistant	4s. 8d.	,, 4s. 10d.	,, ,, ,,
,, ,, ,,	4s. 3d.	,, 4s. 6d.	,, ,, ,,
Coal elevator men	5s. 6d.	,, 5s. 8d.	,, ,, ,,
Sulphate men	5s. 4d.	,, 5s. 7d.	per day.
Tar stillman	5s. 2d.	,, 5s. 5d.	,,
Coke-wheelers	4s. 11d.	,, 5s. 2d.	,,
Fitters	32s.	,, 35s.	per week of 55½ hours.
Yardmen	27s.	,, 29s. 3d.	,, ,, ,,
Exhauster men	4s. 8d.	,, 4s. 11d.	per day.
Service layers	2s. per week extra.		
Meter inspectors	2s. ,, ,,		

NOTE.—The bonus of 2s. per week to men in receipt of 30s. per week or under, and 1s. per week to men in receipt of over 30s. per week is to be discontinued. The bonus is not included in the rate of wages current prior to the change.

EXTENSION OF THE DEVONPORT WATER-GAS PLANT.

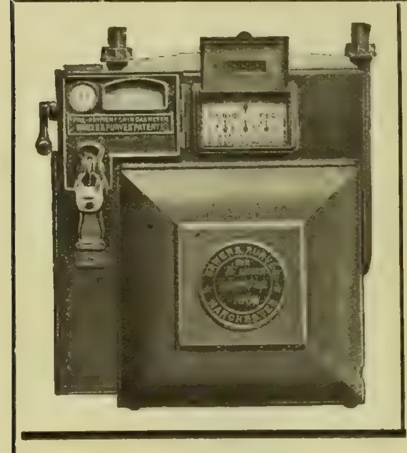
It was reported at the Plymouth Town Council meeting yesterday week that the consumption of gas at Devonport on Christmas Eve was 2,106,000 cubic feet, as compared with 1,980,000 cubic feet on the corresponding day in 1914, which was the previous maximum. The Gas Committee recommended that the Consulting Engineer (Mr. Isaac Carr) be instructed to prepare plans and specifications for increasing the capacity of the water-gas plant as suggested in a report he had presented. It was also proposed to renew mains at a cost of £998.

Alderman Tozer, the Chairman of the Gas Committee, explained that numerous complaints came from the Blockhouse district as to the poor supply of gas; and Mr. Tervett, the Engineer, had discovered that the mains there were very small. The only remedy for the complaints was to put down a larger main at points where they were most needed. They had a loan to cover the expenditure, which would not be incurred all at once.

Alderman Debnam thought that before instructions were given to the Consulting Engineer respecting the water-gas plant there should have been an investigation by a Sub-Committee. It was generally found when plans and specifications were ordered that the work was proceeded with. If it was a question of meeting the consumption of gas, it should be borne in mind that after the war the consumption might go down as quickly as it had lately gone up.

Mr. Daymond expressed the opinion that the plans and specifications should be prepared by their own Engineer, Mr. Tervett. If they left it to Mr. Carr, they would have a commission of 2½ per cent. to pay.

Alderman Tozer, in reply to Mr. Debnam, said it was necessary to



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get the work done in the summer, so that they might be able to maintain the supply of gas next winter; and this being the case, it was essential that no time should be lost. The alternative to enlarging the water-gas plant was an extension of the retort-house and the number of retorts, which meant an expenditure of about £7000. The Committee chose the lesser expenditure. The demand for gas was increasing at the rate of 9 or 10 per cent. per annum, and it was with great difficulty that the supply was maintained at Christmas time.

The recommendations were agreed to.

SOUTHPORT GAS DEPARTMENT AND ECONOMY.

A Special Sub-Committee of the Finance Committee of the Southport Corporation has had in hand since August last the letter of the Local Government Board relative to municipal economy, and have held conferences from time to time with the chairmen, vice-chairmen, and officials of the various departments in order to reduce expenditure to the lowest possible minimum compatible with efficiency. As a result of these conferences, the Committees' representatives promised to further consider matters in the light of the discussion which had taken place, and report.

The report of the Gas Department states that true economy is being practised. All work in connection with alterations and extensions which are not of vital importance has been left in abeyance until such times as wages and cost of materials become normal. The price of coal has advanced 5s. a ton as compared with last year; and the Gas Committee find it difficult to obtain sufficient supplies for their requirements. This, coupled with the erratic working of the railways and shortage of waggons, involves an additional expense of 1s. a ton in placing the coal in, and taking it out of, stock. Sulphuric acid has advanced from £2 to £3 a ton. Last year the Gas Committee were able to procure non-arsenical acid at £2 a ton; but this quality of acid is now largely used in the manufacture of high explosives, and the Committee are compelled to accept crude arsenical acid at £3 a ton. The supply of acid is so uncertain that it has been necessary to order additional plant to concentrate ammoniacal liquor, and so prevent a serious loss to the Gas Estate. The purification of the acid entails additional labour. Fortunately the finished product (sulphate of ammonia) is selling at a higher figure. In accordance with the War Office order, certain products are being extracted from the gas which to an extent reduces its value. To successfully accomplish this process of extraction without unduly inconveniencing the consumers and forcing them to adopt other means of lighting, experiments on a large scale have been carried out at the gas-works. Though at present no money will be made from the process, there is every indication that a profit will be forthcoming in the near future. Owing to the Lighting Restriction Order, a sum of £500 to £600 will be saved on street lighting this year. The Committee are sparing no effort in trying to neutralize the effect which the high prices of materials have on their profits.

NOTTINGHAM'S NEW GAS SHOW-ROOMS.

The opening of new gas show-rooms by the Nottingham Corporation marks a departure of considerable local interest. Hitherto the main depôt for the inspection of lighting, cooking, and heating apparatus has been at Woodborough Road, where commodious buildings, which have been long in the occupation of the municipal authorities, also provide accommodation for the workshops of the meter repairers, meter fixers, and other municipal gas employees. But the site has not the advantage of being central to the main portion of the city; and in selecting new premises at the junction of Houndsgate with Wheeler Gate, the Gas Committee have chosen an eminently suitable spot, which lies on the main route between the great Market Place and the Midland Station.

Some necessary alterations have converted the establishment into a number of attractive show-rooms, in which are now to be seen many of the latest examples of practical ingenuity in gas appliances for cooking and heating purposes, including subsidiary accessories of the requisite domestic type. The Woodborough Road depôt will inevitably still be maintained as the larger centre of exhibition; gas-fittings being there, as hitherto, included within the sale arrangements. Both the establishments are supervised by Mr. George Curtis, acting under the direction of the City Gas Engineer (Mr. John Wilkinson).

It had been in contemplation to arrange for an official opening of the new premises; but war conditions suggested that formalities acceptable at other times might be dispensed with. The result is that the new place has been set going without any ceremony.

FATALITY AT A MANCHESTER GAS-WORKS.

At an inquest held at Manchester last Wednesday, respecting the death of Thomas Dowse, aged 51, a retort-house stoker who had been employed at the Rochdale Road Gas-Works of the Manchester Corporation for over 25 years, and who died in hospital from injuries received on Christmas Day while working in a vertical-retort house, it was stated that he had been accidentally burned by a slight explosion of coal gas.

John Brookes, the carbonizing foreman, said the deceased was working in a retort-house, pricking the coal down and generally keeping the hoppers moving. About 7 o'clock on Christmas evening he was brought to his office suffering from burns about the head and arms. Witness rendered first aid, and sent the man to the hospital. After being attended to at the hospital he returned to the works, but witness sent him home. Deceased told him that the ball had blown off No. 17 retort and had struck him on the left arm, rendering it quite numb. In answer to the Coroner, witness said the coal in the retort sometimes formed into a "cake," and the deceased would have to

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50, John St, Chorlton-on-Medlock,
MANCHESTER.

prick the cake in order to allow the gas to go through. Deceased was not working on the retort where the gas exploded, but was very near to it. Witness's opinion was that a sudden puff of wind came in contact with the gases in the retort, and this caused the explosion. In the course of further questioning, witness said it was only when emptying the retorts that these slight explosions occurred. In reply to a question put by Mr. W. H. Seal, His Majesty's Inspector of Factories for the Manchester District, witness said he agreed it would be better for men not to work at the top of the retorts while the coke was being emptied at the bottom. Witness could not suggest any mechanical contrivance to obviate these explosions. Arthur Dunville, a stoker in the retort-house, said he heard the explosion in No. 17 retort. By the time he got round to the deceased he had been badly burned. Witness could not account for the explosion. Mr. G. W. Tooley, the Manager of the Rochdale Road Gas-Works, explained to the Coroner that the explosion occurred in a retort which was being let down for scurfing. The Factory Inspector told the Coroner and Jury he had seen the installation working on many occasions. It was one of the most efficient and up-to-date plants in the world to-day, and the largest installation of its kind [Glover-West continuous carbonization] in Great Britain. Medical evidence was given that the death was due to shock and septic absorption; aud the Jury returned a verdict of "Accidental Death."

NOTES FROM SCOTLAND.

Gas-Workers' Wages at Perth.—The gas undertaking has again been occupying the attention of the Perth Town Council—this time in connection with an application for an increase of wages on the part of the gas workers. Correspondence that had passed between the representative of the men and the Council was read to the members; the Lord Provost pointing out that the employees occupied an anomalous position. They were under the municipal employees' terms; and now they seemed to desire trade union terms. They could not have both. Ex-Bailie Macpherson remarked that it was strange that, after threats were made, certain things should have happened. Ex-Bailie Wright (the Gas Convener) declared that not a single person at the gas-works was responsible for anything which had occurred there, unless in one case, which was a matter of mere forgetfulness, and nothing else. By sixteen votes to five, it was agreed that the wages question should be referred to the Board of Trade.

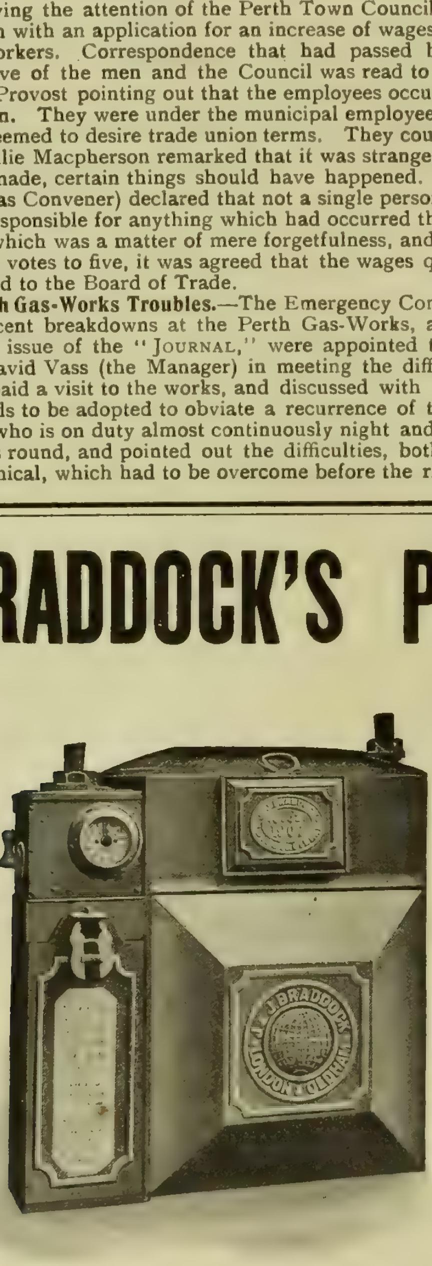
Perth Gas-Works Troubles.—The Emergency Committee who, after the recent breakdowns at the Perth Gas-Works, as reported in last week's issue of the "JOURNAL," were appointed to co-operate with Mr. David Vass (the Manager) in meeting the difficulties, early last week paid a visit to the works, and discussed with Mr. Vass the best methods to be adopted to obviate a recurrence of the troubles. Mr. Vass, who is on duty almost continuously night and day, showed the visitors round, and pointed out the difficulties, both engineering and mechanical, which had to be overcome before the risks of a shortage of gas were removed. A serious obstacle to the re-establishment of an ample supply of gas is the lack of workers. Since the commencement of the war, there has been a scarcity of hands; and recently, owing to illness, the staff was still further depleted. Everything possible is, however, being done to prevent any more trouble with the gas supply. The "Dundee Advertiser," concluding a lengthy article dealing with the subject, says: "The time for mere tinkering is past. Money must be spent in clearing out any machinery which has outlived its day, or which is not producing proper results, and in installing that which will put an end to the present unsatisfactory state of matters. Skilled men must be procured, and adequate salaries paid to them to conduct the engineering part of the concern. Cheeseparing and administrative finesse must be abolished, and the works and the manager given a fair chance, if the confidence of the Perth public in their gas supply system is to be restored."

Buckhaven Gas Supply.—The Gas Committee of the Buckhaven Town Council (Fife) are obtaining the opinion of Counsel on several points before making a final friendly offer to the Wemyss and Leven Gas Companies. It was at first proposed to purchase only the Methil part of the Leven Gas-Works; but it was found later that it would be illegal to do so. The annual manufacture of gas in the two works proposed to be acquired by Buckhaven is 90 million cubic feet.

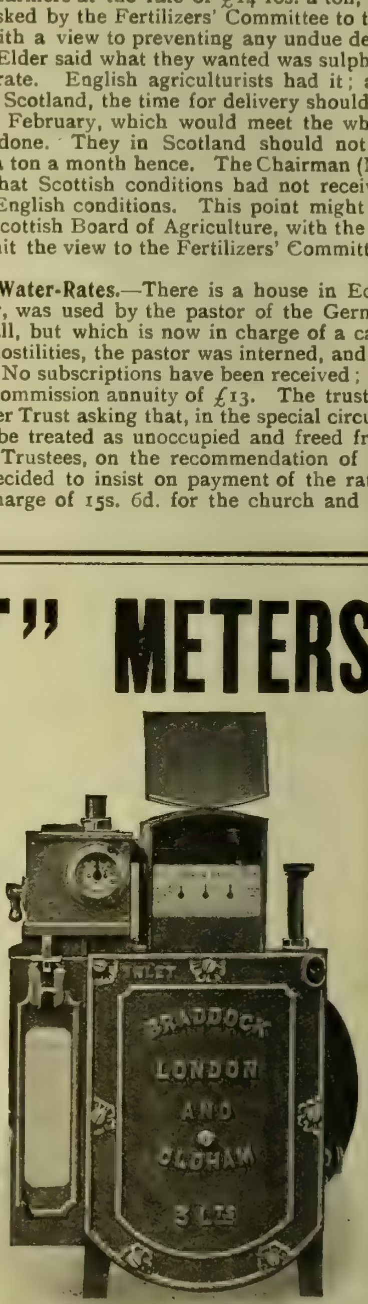
Highland Farmers and Sulphate of Ammonia.—At a meeting of the Directors of the Highland Agricultural Society, letters were read from the Board of Agriculture for Scotland in regard to the supply of sulphate of ammonia to farmers at the rate of £14 10s. a ton, the Railway Companies being asked by the Fertilizers' Committee to take what steps were possible with a view to preventing any undue delay occurring in delivery. Mr. Elder said what they wanted was sulphate of ammonia at a reasonable rate. English agriculturists had it; and they asked that, in regard to Scotland, the time for delivery should be extended from December to February, which would meet the whole case. This had not been done. They in Scotland should not be called on to pay £17 to £20 a ton a month hence. The Chairman (Mr. C. M. Douglas) remarked that Scottish conditions had not received equality of treatment with English conditions. This point might be strongly represented to the Scottish Board of Agriculture, with the request that they would transmit the view to the Fertilizers' Committee. This was agreed to.

German Church and its Water-Rates.—There is a house in Edinburgh which, before the war, was used by the pastor of the German Church and as a church hall, but which is now in charge of a caretaker. At the outbreak of hostilities, the pastor was interned, and he has since been repatriated. No subscriptions have been received; the only income being a Gas Commission annuity of £13. The trustees wrote to the Edinburgh Water Trust asking that, in the special circumstances, the property might be treated as unoccupied and freed from water-rates; but the Water Trustees, on the recommendation of the Finance Committee, have decided to insist on payment of the rates, with the exception of the charge of 15s. 6d. for the church and the hot-water pipes.

BRADDOCK'S PATENT "SLOT" METERS.



THE BEST SLOTS MADE.



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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Jan.* 17.

There is no feature of particular interest to record in the tar products market. Although there are buyers of pitch and shipments are being made, the difficulties of doing business, on account of the freight question, are very considerable. Makers' price is unchanged at 19s. to 19s. 6d. per ton net, in bulk, at makers' works. Solvent naphtha, 90/160, is firm at 2s. 2d. per gallon net; creosote is 4⅛d. to 4¼d. per gallon net—both naked at sellers' works. Business is being done at these prices.

The price of 25 per cent. sulphate of ammonia remains steady at £17 5s. per ton net, into buyers' bags, at makers' works.

Tar Products in the Provinces.

Jan. 17.

There is little fresh to report concerning the market for tar products. Pitch remains very quiet, and shows no signs of improvement. Creosote is still being offered at reasonable prices. Heavy and light naphthas are in very good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. 1d. to 2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 5d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Jan.* 15.

During the past week the market for this material has advanced further, and even at the present level of prompt prices a premium of 2s. 6d. to 5s. per ton has been paid for February-April delivery. The closing quotations for January are £17 15s. per ton f.o.b. Hull, £18 f.o.b. Liverpool, and £18 5s. per ton f.o.b. Leith. Manufacturers have maintained a very conservative attitude so far as delivery over the spring months is concerned, and no business has been reported by them for this period; but dealers are said to have made sales f.o.b. Liverpool at £18 2s. 6d. per ton for February shipment, and at £18 5s. for March and April.

Nitrate of Soda.

The tone of this market is again firmer on spot, and holders now require 16s. 3d. per cwt. for ordinary quality, and 17s. 3d. for refined.

Sulphate of Ammonia.

From another source, it is stated that there has been very little business doing in this article during the past week, and not many transactions are reported. However, the prices remain about the same. Outside London makes, are £17; Hull, £17 12s. 6d. to £17 15s.; Liverpool, £17 17s. 6d.; Leith, £17 17s. 6d. to £18; Middlesbrough, £17 15s. to £17 17s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is brisk; the demand exceeding the supply, and the tonnage scarcity interfering somewhat with the shipments. Rates of freight, too, are so high that they impede business in the coal trade—forward work especially. In the steam coal trade, the inquiry is full, and the prices are firm all round. Best Northumbrian steams are 25s. per ton f.o.b.; second-class steams are 21s. per ton; and steam smalls seem to be well taken up, and vary from 11s. 6d. to 15s. per ton f.o.b. The output is well taken up, except when the stormy weather interferes with the arrival of steamers that have been expected by the collieries. In the gas coal trade, there is a strong tone. The consumption is full, and prices are well maintained. Best Durham gas coals are from 22s. to 22s. 6d. per ton f.o.b.; for second-class gas coals, about 20s. to 21s. per ton is quoted; while for "Wear Specials," 23s. to 24s. is about the current price. For export these rates are well held; but for the home contracts now in course of negotiation, it seems to be doubtful how far these high figures will prevail. Still there is a strong tone, and the production is barely normal. Freights continue to advance—31s. having been paid for a steamer, Tyne to Havre, with other rates in proportion. In the coke trade, the market is firm, and exports are rather more than a year ago. Good gas coke is from 28s. to 30s. per ton f.o.b. in the Tyne; and as the output must now be expected to decrease, it seems probable that the price will remain firm. The stocks of coke are limited at shipping ports, but inland are sometimes heavier.

Wath-upon-Dearne Gas Extensions.—A Local Government Board inquiry was held last week at Wath-upon-Dearne into applications (to which there was no opposition) by the Wath and Bolton Gas Board for power to amend their Act of 1908 so as to provide, among other things, for the inclusion of the Thurnscoe Urban District Council as a constituent authority, and for sanction to a loan of £7500 to meet capital expenditure already incurred and required in the immediate future.

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Gas Supply of Accrington.—Speaking on Thursday at a meeting of the Accrington Trade Council, Mr. J. R. Emmett again raised a question regarding the gas supply. He said the explanation published on behalf of the Accrington and District Gas Board did not hold out much hope of a better supply; and he therefore moved that the matter be taken up by the Trades Council Executive with a view, if possible, to the calling of a town's meeting. This was agreed to.

Cost of Producing Sulphate of Ammonia.—Replying in the "Western Morning News" to a letter which had appeared in a previous issue, Mr. D. Milne Watson (the Chairman of the Sulphate of Ammonia Association) points out that it is wrong to state that the Government are doing nothing to help the farmers to secure their spring supplies. In fact, he says, the Association have been in close touch with the Board of Agriculture for the last three months regarding prices and supplies. They have arranged to limit the price for home consumption in the spring, and also to reserve a very large margin over and above normal spring requirements. As a consequence, the export trade will be enormously curtailed; and this will mean a heavy sacrifice to manufacturers, especially in view of the great increase in the cost of production, which in some cases amounts to £6 and £7 per ton.

Reducing the Unaccounted-for Gas.—In his report to the Middlesbrough Corporation last Tuesday, Mr. David Terrace (the Gas Manager) said that from the annual cost account, it would be observed that the unaccounted-for gas had been very much reduced during the past year; a leakage of only 2·7 per cent. having taken place. As a rule, from 6 to 7 per cent. was reckoned as the quantity; and the amount saved would be £700, calculated on the cost of gas in the holders. There were 134 miles of main, from 3 to 18 inches in diameter. The number of consumers had increased to 25,451.

The Danger of Dark Streets.—The lighting of the streets was referred to at last Tuesday's meeting of the Deptford Borough Council, when Mr. Steele asked whether a conference of mayors would be held to discuss the question of a uniform system of lighting. The Mayor (Mr. W. A. Wayland) replied that he quite hoped one would take place before the next meeting of the Council. The question of street lighting was in a very disorganized state, in consequence of the differing systems; and the whole of London was responsible to one individual. He hoped the agitation would bring about amelioration. Many people would have been alive to-day but for the badly-lighted streets, which were practically in semi-darkness.

STOCK MARKET REPORT.

The Stock Exchange has had a quieter week. On the whole there was not much harm in this; for some markets were beginning to look as if they would be better for a little checking. A boom in some quarters was apparently being engineered; and booms are not infrequently followed by disastrous slumps. And such a phenomenon just now, in the anxious times through which we are passing, would be fraught with more than usually sinister consequences. So business was moderate, and the tone, taking all things into account, was very fair, though changeable. The War Loan and Consols closed firm, though inclined to give way a bit in midweek. Home Rails were uniformly strong throughout, and added one more good week's work to the recovery, which these much-tried securities have long been looking forward to. The American Market was weak owing to various troubles—Mexican and domestic; and Canadian lines were involved. In the Foreign Market, the French loan went weak, but pulled up again before the finish. Argentine Rails were strong, aided in some measure by American demands. There was some profit-snatching in South Africans; but they stood it very well. In the Miscellaneous group, Rubber was again the most conspicuous line; and a reaction set in which will be conducive to health and strength in the sequel. The enormous advances in freights drew attention to Shipping concerns; and Armaments and Oils were in some demand. Among general topics, the dollar securities' mobilization is going well, and the expansion of the scheme is encouraged. The Government offer 2½ per cent. discount on prepayments of July income-tax; but with money at its present value, the offer does not look tempting. The unwelcome New South Wales loan was poorly supported. Disappointment was felt at the minimum prices being left *in statu quo*. Business in the Gas Market was again on the quietest scale. A noteworthy feature was the firmness of Gas Light and Coke issues; the ordinary pushing up from 70½ to a closing mark of 72¾. The market may gather some animation when the accounts to December, 1915 (now in preparation), are out. The Money Market was firm.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 71, ditto maximum 60½, Sheffield "B" and "C" 174⅞, 175, South Metropolitan 77, 78¼, ditto debenture 60. On Tuesday, Alliance debenture 62, Gas Light ordinary 71, 71½, South Metropolitan 77. On Wednesday, Gas Light ordinary 70½, 70¾, 71, 71½, 72, Monte Video 8⅞, 8 15/16, 9. On Thursday, Gas Light ordinary 71¼, 71½, 71¾, Newcastle 81. On Friday, Bombay 5½, Gas Light ordinary 72¼, ditto preference 75⅞, 76¼, Primitiva 2⅛, River Plate 70. On Saturday, Gas Light ordinary 72¼, 72½, 72¾, ditto preference 76¼, 76⅜, Primitiva preference 3½. Bargains in the following unquoted companies were marked on Monday: Ascot, and Grays £8 19s 6d. and £9 each, Felixstowe 99⅞, 100, Great Grimsby 138⅜, 138½, Southend 84⅞, 85, and Worthing 79⅞, 80.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

At a meeting of the Walsall Town Council, the Gas Committee reported having given instructions, owing to the abnormal conditions now prevailing, for the rent of gas-cookers to be raised 6d. per quarter.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	8 18 2	..
874,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 8	62
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	5½
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
873,480	10	"	7	7/-	B 7 p.c.	15—15½	4 10 4	..
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	66/-	Brentford Consolidated	261—266	5 5 8	..
830,000	"	"	†11	55/-	Do. New	204—209	5 5 8	..
50,000	"	"	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 8 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	2½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26		4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—		—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	–	4 6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	"	"	5¼	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	..
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	70½—72¾
2,600,000	"	"	3½	3½	3½ p.c. max.	76—79	4 8 7	60½
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10	75⅞—76⅜
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	"	"	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	..
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7		Liverpool 5 p.c. Ord. B	146—148	4 14 7	
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	8⅞–9
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	81
529,705	Stk.	June 26	3½	3½	Do 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	"	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	"	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4	2⅛
499,960	5	June 26	5	2/6	" 5 p.c. Pref.	4¾—5	5 0 0	3½
521,600	100	June 2	4	4	" 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	70
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
209,984	"	"	10	0	Do. B	222—224	4 9 8	174⅞—175
523,500	"	"	10	10	Do. C	220—222	4 10 1	174⅞—175
90,000	10	May 28	9	6-	South African	10½—11½	7 16 6	..
6,429,895	Stk	Feb. 12	5/4/0	44/	South Met., 4 p.c. Ord.	111—113	4 16 8	77—78¼
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60
209,820	Stk	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	..	"	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	135—138	5 8 8	..
742,275	"	"	6	6	B 3½ p.c.	115—117	5 2 7	..
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/6	55/1½	" C 3½ p.c.	110—115	5 2 0	..
852,000	"	"	6¾	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	"	"	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

Coke Prices.

A question was asked by a member at last week's meeting of the Sutton-in-Ashfield Urban District Council as to what were the circumstances which justified the Gas Committee in charging £1 per ton for coke, when at the neighbouring town of Mansfield the charge was only 15s. 10d. If such a price was considered reasonable, it seemed to him they could not complain of colliery companies unduly increasing their rates for coal. In reply, the Chairman of the Committee (Mr. John Briggs) said he understood that the Mansfield Gas Committee had decided to increase the rate from 15s. 10d. to £1 a ton. That very day he had had an offer from Birmingham for ten trucks at £1 per ton; and he thought that if coke could be sold for £1 per ton it was their duty to charge it. Seeing that the number of small consumers in the district was very limited, he did not think the Committee had done wrong in raising the price. Mr. Spencer suggested that a fair price to ratepayers should be based upon the cost of coal; and it should be kept at that, and not be governed by contract prices. Mr. Briggs replied that it had been the rule to charge more for coke sold in small quantities; and he thought it was their duty to make as much out of the undertaking as possible.

Lighting Economy at Tiverton.—A motion in favour of lighting the courts at Tiverton was rejected by the Town Council yesterday week. It was stated that £450 was saved on the lighting account last year; and the Council generally were of opinion that any question of increasing the lighting of the town should be postponed until the end of the war.

Applications for Increased Wages at Manchester.—The printed minutes of the Manchester Corporation Gas Committee denote that on Dec. 24 last a number of applications for advances of wages were received from various Societies—all affecting men employed by the Committee. They were referred to the Workmen's Special Committee for consideration and report. At the same meeting an application was received from the Manchester Team Owners' Association for an advance in the charges for the conveyance of gas-stoves, &c. This was agreed to by the Committee.

The Loss of the "Ignis."—Reference is made in the current issue of the "Co-Partners' Magazine" to the loss of the Gas Light and Coke Company's steamer "Ignis," which, as already recorded, was sunk on the afternoon of Dec. 8, presumably by a submerged mine, a few miles from Aldeburgh. The steamer was on a voyage from Newcastle with 2992 tons of coal for Beckton. The weather was fine and clear; and nothing unusual was observed until the explosion occurred. Within a few seconds the hatches were blown off; and the vessel began to sink rapidly by the head. The crew took to the boats; and not until it was ascertained that all were in them did Captain Laird leave the vessel, which was then well down at the head, only five minutes after the explosion. After rowing for about twenty minutes, a mine sweeper took the crew on board and the ship's boats in tow. The crew were safely landed on the beach at Aldeburgh. Fortunately, no member of the crew was seriously hurt; but several of the men in the forecastle and the look-out men received injuries of a minor nature. Captain Laird was master of the s.s. "Fulgens," which was torpedoed on Aug. 1 last.

A Charge of Gas Stealing Fails.

Before Mr. W. L. Williams, K.C., M.P. (the Recorder), at the City of Cardiff Quarter Sessions, Charles Lawson, of the Universal Hotel, Bute Street, was indicted for stealing a quantity of gas, value 1s., belonging to the Cardiff Gas Company. For the prosecution, Mr. Francis-Williams explained that the defendant did not live at the hotel, but left it in charge of a Mrs. Davies. The latter, finding there was a leakage of gas, communicated with the Gas Company without defendant's knowledge. On Oct. 29 two of the Company's workmen visited the premises to undertake the repairs. On entering the cellar, they found two jets burning, and were surprised to see that even after they had turned off the gas at the meter the jets continued to burn. They then noticed two cocks, one on the inlet-pipe to the gas-meter and the other on the outlet-pipe, connected by a rubber-tube, so that gas could pass into the premises without going through the meter and be registered for payment. A report was made to the Company, and a further examination led to the discovery that the rubber tube had gone. By the smell of the taps, however, the officials of the Company were able to say that they had been recently used. Counsel asked the Jury to come to the conclusion that this device had been fitted by the defendant, or that it was used with his knowledge. Evidence having been called to corroborate the statement, defendant, in the witness-box, denied any knowledge of gas stealing. He said he had never fixed, or ordered to be fixed, any rubber tubing for the purpose. The cocks referred to must have been put on the pipes over fourteen years ago, before he entered into possession of the premises. He had never noticed them, as the pipes were the property of the Gas Company, and had nothing to do with him. Mr. Ivor Bowen (for the defence) pointed out the danger of convicting a man on circumstantial evidence; and the Jury, after retiring for three-quarters of an hour, returned a verdict of "Not guilty."

Considerable inconvenience was caused last Wednesday afternoon at mills and workshops in the Whitworth district through a failure in the gas supply. At some of the places where gas-engines are used work had to be stopped altogether. In the shops and other places requiring gas, candles were used for illumination.

Late last Tuesday night the Blackburn Fire Brigade received a call to the Addison Street Gas-Works, where they found a building, 45 feet by 15 feet, used as a garage and cart shed, on fire. The flames were extinguished in twenty minutes. It was reported that two motor-cars, a cart, and other contents of the building were damaged; and part of the roof was demolished. The cause of the fire could not be ascertained.

The Local Government Board have refused to sanction the borrowing of £700 by the Todmorden Rural District Council for the purposes of a water supply at Calden, Heptonstall, as they are advised that the scheme is unsatisfactory. They say they would not have agreed to a loan, quite apart from the restrictions caused by the war to be placed upon borrowing applications. At the Board's inquiry, some months ago, it was stated that the work for which this money is required had already been carried out without consulting the Board; and on this occasion the County Council representative had criticized the scheme as not being sufficiently comprehensive.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Manager. No. 6144.
Working Foreman. No. 6135.
Working Foreman. No. 6136.
Working Foreman. No. 6141.
Assistant to Take Charge. Redhill Gas Company. Applications by Feb. 2.
Tar Still Attendant. Perth Gas-Works.
Clerk. No. 6132.
District Work (Mainlaying, &c.). No. 6142.
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Tar Still. Cork Gas Company.

Meetings.

Imperial Continental Gas Association. Cannon Street Hotel. Feb. 2. 2.30 o'clock.
South Metropolitan Gas Company. De Keyser's Hotel. Feb. 9. Two and 2.30 o'clock.
South Suburban Gas Company. De Keyser's Hotel. Feb. 11. Three o'clock.

TENDERS FOR

Coal.

Morecambe Gas Department. Tenders by Jan. 29.

General Stores (Lime, Sulphuric Acid, &c.).

Morecambe Gas Department.
Ossett Corporation. Tenders by Feb. 12.
Salford Gas Department.

Meters.

Ossett Corporation. Tenders by Feb. 12.

Naphtha. No. 6138.

Pipes, &c.

Ossett Corporation. Tenders by Feb. 12.

Retort Renewals, &c.

Middleton Gas Department. Tenders by Feb. 3.

Tar and Liquor.

Birkenhead Gas Department. Tenders by Feb. 9.
Morecambe Gas Department. Tenders by Jan. 29.

Tar Still.

Cork Gas Company.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

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See Illustrated Advertisement, Nov. 16, p. 354.

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VOL. CXXXIII., No. 2750.] TUESDAY, JANUARY 25, 1916. [68TH YEAR.

EDITORIAL NOTES.

Fuel Economy and National Necessity.

As we anticipated would be the case, Professor William A. Bone, F.R.S., has taken up with energy the work that, with especial appositeness, lies at his hand—of pursuing a campaign against the national foe of fuel waste, and urging the adoption of constructive measures that would result through fuel saving in the promotion of the country's economic opportunities and welfare. The campaign was started by him in his Presidential Address to the Chemical Section of the British Association; and through that address the real importance of the subject was transmitted to others. The address was followed by the appointment of a strong and influential Committee, to make thorough investigation and to report, through the Association, to the public and, if need be, to the Government. The British Association could not have taken under its *ægis* a matter of greater practical value to the nation; and, so encouraged, no time has been lost by the prime mover in doing what has been possible by a single individual in stimulating public interest, and particularly that of the industrial users of fuel. Addresses on the subject have been given by him before various Associations—among them a short one at the dinner of the Coke-Oven Managers' Association. Now he is hammering away at the question in, or at any rate he is weaving it well into the composition of, three Thursday afternoon lectures, on the "Utilization of Energy from Coal," that he is delivering at the Royal Institution. He has a prominent platform there; but it could be wished that, through the lectures, the general Press of the country could be brought to see that there is a topic here for them that is equally as momentous as, and one which has a more concrete foundation than, that of *post*-war trade, to which columns of most of the daily papers are being regularly devoted, and which is in some quarters being treated in a very abstract manner. In the first lecture alone (as will be seen elsewhere in this issue), a good case is—particularly in the first and the last sections—made out for the action that is being taken, and for more determinate action still on the part of the Government. If the deserved reward crowns this work, then Professor Bone will have brought to the country more material benefit than have done—necessary and valuable as they have been to progress in knowledge and in the application of scientific discovery and rule to practical ends—those refined researches within the laboratory that have placed him in the fore rank of contemporary scientists.

In the first lecture, no room for doubt was left in the minds of the audience as to the lecturer's feelings upon the subject of the waste of fuel. He hit at it straight from the shoulder, and raised it from the commonplace of a mere monetary question to the individual user of coal to a position of primary importance in national economics. Any form of waste is an evil in itself; but waste multiplies evils—in this case, in a manner which causes deterioration to, and destruction of, both life and property, and lays to waste much of Nature's provision for our health, wealth, and delight. There is large work to be done in making the people individually and collectively appreciate that coal, which is the very root of our national prosperity, is a storehouse of substances each of value, and in the aggregate of immeasurable worth, and that every process utilizing coal which unnecessarily destroys any of those substances in realizing (say) only one of its properties is a contributor to the destruction of usefulness and therefore of wealth. Economy is being freely preached to the people by politicians and economists; and the country is being flooded with words and precept which are largely out of touch with practical attainment. Here, however, a practical matter is presented through which huge economy may be achieved, and the fortunes of the country be progressively augmented. Yet few appreciate and understand it, though waste protrudes its hideous features in all large centres of population and of industrial activity. Of course, a revolution from waste to economy, where the conversion of processes means research and time, cannot be accomplished at a word of command. Legislation itself could not bring about any immediate conversion. It cannot therefore be hoped that much progress will during the war be made in this matter, except in the way of preparation. There is, however, considerable preparation to be made, and that is what is of particular concern at the present time. Even so, with present processes, there is much that could be at once done by improvement in supplementing necessaries for which there is imperative and enlarging request in connection with the prosecution of the war. In this connection, the Ministry of Munitions comes in for censure from Professor Bone, for "culpable negligence" in having so far disregarded warnings and representations concerning the importance of organizing a more competent chemical supervision over the bye-product coking plants from the point of view of enhancing the yields of both benzene and toluene.

We have also to look forward to what Professor Bone, early in the lecture, calls the "trying years of economic "recuperation and readjustment" that will follow hard on the termination of the war; and the country should start upon those years with the deliberate intention, under the encouragement of the Government—insistence could come later if need be—of converting present fuel waste into national profit. When Professor Bone speaks of savings through the proper utilization of coal in terms of millions of pounds, he is not using the language of the hyperbolist. He is fully cognizant of the approximate value there is in a ton of different classes of coal; and he also knows approximately the quantity of coal per annum that is used destructively to all its properties but the one of heat raising or the realizing of a single product. Millions of pounds saving per annum! And capable of being saved in our very midst! These are statements that should arrest the attention of our politicians and economists, should excite their interest, and should stir them from past lethargy due to ignorance upon the matter to very positive action.

There are those who think a potent and sufficient impelling force in securing fuel economy will be the certain prospective higher prices of fuel; but we are with the lecturer in the opinion that such process alone would be very slow. In fact, leaving the production of economy to the operation of this force would only aggravate the uneconomy, through the ease of the course of transferring the additional fuel costs to the consumer of the products resulting from the use of the fuel. There are excellent examples, and Professor Bone knows of them, of proved economy by the application of new processes and the setting-up of proper supervision—chemical and otherwise. This proved economy, however, has not had universal effect; the old wasteful processes have been kept alive by indifference, and have continued to pursue their value-destroying way to attain nothing better than the old goal. A larger and higher incentive is now necessary. Professor Bone does not ask at first for drastic legislative measures and interference in securing fuel economy. It is necessary to go to work constructively. "What is needed is a patriotic exchange and "pooling of experience—a willingness to co-operate whole-"heartedly and effectively, under skilled guidance and ad-"vice, for a national benefit; and this cannot be achieved "except on the basis of some national organization." Beyond this, a systematic investigation of the chemical nature of coal and a chemical survey of the principal British coalfields are needed. For this work, "we already have in the "country all the means, as regards men and equipment; "and it only remains for the authorities who administer "money voted by Parliament for scientific and industrial "research to provide adequate grants for its effective prose-

“cution.” There is nothing revolutionary here—nothing impossible of attainment. It is only common sense. The work of developing fuel economy is one that must be undertaken systematically and by gradation. The initial steps are the only ones Professor Bone has at present under consideration; and they are immediately sufficient. From them, if accepted and prosecuted, will issue development towards the ultimate goal.

Sliding-Scale and Dividend Shrinkage in Abnormal Times.

Noticed lately have been further instances of additional increases in the price of gas having been necessitated by the inexorable circumstances inflicted by the war; and in the case of sliding-scale companies, these extra increments of price to produce larger revenue mean to the proprietors the sacrifice of still more dividend. And it is a question whether, in the case of certain not well-placed companies, the relationship between price and dividend will not be still further widened. There is under present conditions good cause for very deep sympathy with the proprietors in some sliding-scale gas companies; for the very system that maintains a happy position between them and the consumers in normal times is making their investment in gas less and less valuable as a contributor to their financial needs just at the period when these needs are the greatest. They are in the present darkened and inordinately conditioned days—when prices to consumers are forced up by the accumulation of every species of abnormality that ever formerly, but individually, came on the undertakings, and net dividends are forced down by the sliding-scale—in infinitely worse case than shareholders in maximum-price gas companies and concerns in other industries that can better “trim their sails to the prevailing wind,” by advancing prices to meet the war-imposed burdens, without maybe losing anything in the way of dividend.

We dealt specially with this matter in the “Journal” for Sept. 28 last; and now as we see the costs of materials still rising, difficulties of transport still active and worrying, labour expenses and labour shortage with tendencies in the directions contrary to those that would be helpful, the creeping upward of the expenses brought about by humane considerations for fallen, incapacitated, and absent employees, the still reduced business through military requirements and local protection, and through the business inertia brought about by the forceful claims of economy, the difficulties of capital raising, and the additional obligations imposed upon gas concerns by patriotism and loyalty to country, we also see the strengthening importance of this matter of the effect of the sliding-scale in such a time when everything has deviated from the path of regularity. With the coming-in of income-tax demands and the knowledge of the heavier income-tax deductions that are to be made from the half-year's dividends shortly to be declared—weightier income-tax on much lighter dividends under the sliding-scale—the position of many gas proprietors will not be a happy one. Of course, such maleficent conditions were never contemplated at the birth of the sliding-scale as applied to gas companies. But we have them now, and are feeling their full effects. It is therefore a question whether something should not be done to bring about an extension of the sliding-scale by making provision to, at the discretion (say) of the Board of Trade, relieve proprietors of companies working under it of at any rate the full results of conditions that cannot be classified as ordinary, and that produce, as now, something much more burdensome than is the case with the comparatively simple irregularities of peace times. It may be remarked: “Why worry about making such provision, seeing that we are not likely to have another world-disturbing war like this for many a generation.” We hope not. But who can tell? And having experienced a defect, why not move to get it remedied? With the fusion of labour organizations, including the miners and transport workers, for militant purposes in respect of their affairs, there may come such internal dissension and disturbance of conditions that, with shortage of material and a ramp in prices, an appeal to the Board of Trade for the suspension of the sliding-scale, in relation to additional costs directly produced by such occurrences, might be very valuable in assisting to protect gas proprietors and maintain the good opinion of investors and the market value of gas stocks, as well as the capital-raising position of companies. We quite recognize that, in any circumstances, some sacrifice would have to be made before there could be any movement to disturb the operation of the sliding-scale; but the sacrifice ought not to extend to the depreciation of income, stock values, and position now being experienced, or that might be experienced in conceivable circumstances other than an international war.

Such revision or extension of the sliding-scale, however, is a matter for the future, and not the present. As to the present, it has been on a previous occasion suggested in the “Journal” that there ought to be suspension of the sliding-scale in respect of such increase in the price of gas as is the direct outcome of the war, and which increase, through the effect upon dividends, has brought about the very grave depreciation of stock values and capital positions. Suggestion has also been recently made that one of the organizations of the industry should at once take up the matter of trying to secure a suspension of the operation of the sliding-scale in respect of the super-costs chargeable to the war. Such suspension of the law could only be brought about by the passing of a short Act of Parliament; and the Government are not at all likely to consider at the present time the passing of short Acts for the special convenience of a single industry, especially seeing that they will not look at measures of even general importance, unless they immediately concern or grow out of the war. It may be said that this matter of shrunken net dividends does grow out of the war. We know it does. The difficulty would be to get the Government to appreciate what we in the gas industry appreciate, and some of us acutely feel. The sliding-scale was accepted for better or for worse; and no one thought of a provision to cover exceptional and exigent circumstances. We have to suffer from the omission now, and, so far as we can see, must grin and bear it, though it presses hardly on the investor of slender income, and on the widow and orphan with perhaps no other financial resource. But, under the circumstances of to-day, let us take thought for the morrow. We may not ourselves benefit from an amendment of the sliding-scale such as is suggested (we hope there will be no occasion to), but to think only of ourselves, and not of our children and the future conditions of the industry, and to make no effort (because it may not advantage us directly) to remedy a legislative defect revealed by extraordinary conditions, would be a very selfish and an impolitic attitude.

Coal at Six Pounds per Ton for Gas Making.

The country is at length being aroused to the nature of the heavy burden that it is being called upon to bear, through the prices of its necessaries in food and otherwise, by the enormous profits that are being made by shipowners on their tonnage. The newspapers are alive with articles and correspondence upon the subject. In Parliament, too, the question is being frequently referred to; and the Government are not coming with flying colours out of the ordeal of a critical examination of their do-nothing policy. As a matter of fact, they have not done anything to stop the upward flight of rates, nor have they attempted any control of shipping. On the contrary, they stand convicted of having adopted methods in the requisitioning of ships for transport work which have been a factor in forcing-up prices. There has been an extravagant waste and mismanagement of the requisitioned tonnage; and this is practically admitted by Mr. Runciman when he acknowledges that an endeavour is now—only now!—being made to co-ordinate more closely the demands for tonnage for naval and military purposes and for munitions and food for this country and its Allies, with a view to the securing of economy in the requisitioned steamers and to increasing the available tonnage.

Confessedly, there is pressure on tonnage; but some experts assert that, if properly handled, the tonnage at command before the war, making due allowance for wastage through the war, would be sufficient for ourselves and our Allies. The “shortage” due to the asserted mismanagement is translated into inequality of supply to demand. And the operation of the law of supply and demand is put forward as the excuse for what is happening. But the published rates of freight and other data show that, whatever the causes of the demand exceeding the supply, there is no law that can appease or restrict the appetites of the shipowners. The fact that fabulous profits are now being made by them out of the war conditions cannot be gainsaid, although the published figures by reputed authorities inform us that, if 50 per cent. were added to pre-war rates, the extra costs due to the war would be amply satisfied. The owners say that whatever their excess profits, the Government, under the new Finance Act, will benefit to the extent of 50 per cent. But the fact stands out clearly that, since the introduction of the Budget, the owners have put up the rates to such an extent that, after deducting 50 per cent. of the excess profits, they will still be in as good a position as they were in before the introduction of the Budget. Another point of interest that has transpired is that hundreds of ships have been sold to neutral countries since the war began. This ought to have been prevented.

Owing to the freight situation, a large number of gas undertakings at home which have to rely on seaborne coal, and have no ships of their own running, are suffering enormously; and in many instances owing to the congestion on the railways, and especially is this the case with towns in munition-producing areas, where the sidings are rarely free, it is a question of Hobson's choice—either the rates of freight have to be paid, or the supplies of coal be deficient of requirement. But although such home gas undertakings are suffering acutely, the injury to them—though indefensible—is modest in comparison with what British gas undertakings working abroad, and the gas undertakings in allied countries using British coal, are suffering. We recently referred to the Milan Gas-Works (in which the Continental Union Gas Company are heavily concerned) as a case in point. Only last week, it was announced that at one time freights to Genoa had risen to 86s. per ton (80s. was subsequently quoted); while before the Boer war a rate as low as 3s. 10½d. was accepted. Add to the 86s., possibly, 22s. per ton for Durham coal, and several shillings for labour, distribution, and handling expenses from Genoa to the stores of a gas-works at a distance, something not far short of £6 per ton would be reached before the coal is put to the use of gas-making. With a gas-production of 12,000 cubic feet per ton, this works out to 10s. per 1000 cubic feet, less residuals. Yet this is in all probability not the worst case that could be taken for illustration.

French Masks for German Pipes.

Since the war started, attention has been prominently and frequently directed to the ramifications of German trade in all countries. In this country, it has been found in every city, town, street, and at our very doors; and yet many of us failed to recognize it. The reason for this is that, while some of the trade was conducted openly, much of it has been carried on through agencies or under guises denoting a nationality other than German. This commercial stratagem and deceit find their only commendation in the cleverness that has brought about success in befooling the people in practically every country. This befooling is, however, now having applied to it the old saw, "Once bitten "twice shy." People do not like to be accounted the subjects of the artifices of such wily ones as German traders; and having been once duped, and convicted of having failed to penetrate the disguises, they will use every effort to avoid being placed a second time in similar position. One of the masked companies is La Société Metallurgique d'Aubrives et Villerupt. With this Company British gas and water engineers have long been doing willing business for various reasons—such as price, the attractions of the mode of vertical casting, and in furtherance of the *Entente Cordiale*. The German has smiled, and has rubbed his fat hands gleefully over the success of his duplicity. Since 1909, at the head of this concern with the name in unblemished French has stood Herr Thyssen, and at his back has been the Gelsenkirchen. While, therefore, gas and water engineers have been under the impression that they have been doing business with a French firm, their payments for these pipes have actually being profiting Germany. This is only part and parcel of a well-conceived and equally well-executed scheme on the part of German manufacturers and ironmasters for securing control of the French iron mines and foundries, and to continue trading under the old style, which in the new circumstances is deceptive. Now the question for British gas and water engineers is, "Are we going to continue to help the Ger"man money-making machine henceforth by purchasing "pipes which *de facto* are German, though enveloped in "a French name?" This in effect is the question that "Anti-Germanicus" puts in a letter in our "Correspon"dence" columns to-day; and we are obliged to him for doing it. To relieve him of any notion on the part of others that there is some personal motive at the back of his communication, we may say at once that he is an engineer—a "M.Inst C.E."—interested in both gas and water supply, and without any ties so far as pipe founders and pipe selling in this country are concerned. But he does feel very keenly the bamboozling of British engineers by Germans in the manner related in his letter; and, in his opinion, some effort should be made so as to prevent resumption of this form of trading and unfair competition—unfair, while the goods are admitted to this country free, but a barrier of import duties in other countries limits the export opportunities of British pipe founders. We shall be pleased to help forward any movement in the preventative direction which commends itself, and is well-supported. The question is, What form should this effort take? There might be an open declaration that no more business will be done in foreign produced pipes unless there is perfect satisfaction that the firms with whom the business is being done are entirely free from German control and (in whole or major part) financial influences. The subject of the nature of the effort that should be made is one that would bear discussion

Construing an Agreement.

There are unusual features about an arbitration, the proceedings in which extended over last week, which had for its object to determine the price to be paid by the local Urban District Council, under an agreement confirmed by the Council's Act of 1914, for the gas undertaking of the Shropshire Union Railways and Canal Company. From the report of the opening speech and evidence for the Company, which is given to-day, it will be seen that originally the Company supplied only their own premises with gas; but later on they were asked to give a public supply, and did so. The Company's witnesses valued the undertaking as a whole; but when, on the fourth day of the hearing, the Council's case was opened, the point was formally taken that what the Company had agreed to sell, and the Council had agreed to purchase, was the undertaking for supplying gas which was not needed by the Company for their own purposes; and that they could not sell the right to supply gas which they needed themselves. In other words, what they were selling was the public portion of the concern—"a separate undertaking supplied from the old gas-works." This matter having been discussed, Counsel on both sides asked the Arbitrator to give his award in an alternative form, so that it might be taken to the Courts as a special case. On Monday, however, a settlement was arrived at between the parties, on the "separate undertaking" basis. An account of the later proceedings in the arbitration is held over until next week.

Gas in the Studio.

This is an old subject; but there is sufficient reason for it being raised anew in view of the changing conditions under which studio photographic work is now carried on. The application of gas to the purpose of portrait taking has never been tackled—at any rate, in this country—in a proper spirit, and with the requisite technical knowledge to make a success of it. The work that was done years ago was with low-pressure burners. Then installations were of a somewhat crude order; and there were perspiring moments as one sat between two rows of upright incandescent burners. But since then, spasmodically, there has been some experimental work with modern burners; and excellent portraits have been produced by their means. Our columns, too, have borne testimony to the production in gas-lighted interiors of work that could not be excelled for clear definition and detail, admittedly with longer exposures than would be tolerated for portrait work. This being so, it seems a pity that some more deliberate effort is not made to bring gas lighting definitely to the aid of the photographer in his work in the studio; for we believe that incandescent gas lighting does really possess all the qualities needed to produce good result, if there is proper application, and especially if the announcement made by the American Illuminating Engineering Society is correct, that progress has been made in the production of a mantle for incandescent gas-burners yielding a light of high actinic merit. This announcement has inspired the writing of an article which appears in other columns to-day, and which will be found very useful to those who would like to further investigate the matter, to see whether some better means cannot be devised for making a practical application of gas lighting to photography.

The Photographic Field and the Requirements.

The article shows that the field is large for utilizing gas for photographic purposes, if a proper system can be devised; it shows, too, that means of artificial lighting for portrait taking are an absolute necessity to-day to the professional photographer. It gives to him greater choice of location for his studio; it increases his working capacity; and the time extension for business enlarges his patronage. Electricity has hitherto held the field among high-class men on account of its ready applicability, rather than owing to any claim it can make to perfection in its qualities for the work. It is not by any means perfect—the fluctuations of arc lamps are bad; and the nitrogen-filled lamps cause trouble by their vacillating actinic energy with variation of load. With high-pressure gas-burners, and with low-pressure burners on a governed service, there are no flickerings or fluctuations of light; but, especially with the former, one can obtain a well-diffused and perfectly steady light, with (experimental work has proved) all the properties required. What is more, using fairly low-unit high-pressure burners, there would be, compared with low-pressure burners, a reduction in the quantity of gas consumed in relation to the power required in the studio. The article in other columns does not mention high-pressure gas lighting. And there might be difficulty in giving high-pressure supplies to the class—and it is a large class—of photographer specially referred to in the article. They could hardly afford individual installations, any more than they can afford to have electric lamps installed for their work. Those off the line of an electric cable will also in all probability be off the line of a high-pressure gas-main, unless their studios are in main streets, and in districts of enterprising gas authorities. The article sets out the requirements of the photographer; and we shall hope to hear it has had a stimulating effect. From anyone who has had practical experience in fitting-up for portrait taking the studio of a professional photographer, we shall be pleased to receive a description of the installation, and some account of the experiences with it.

A Tribute to the Gas-Furnace Makers.

The valuable work done by the gas-furnace makers, in designing and constructing in the shortest possible time, gas-consuming apparatus eminently suitable to meet the varied requirements of munition factories and workshops—of which full acknowledgment has already been made in the pages of the "JOURNAL"—was testified to by Mr. R. J. Rogers, in the course of a lecture, delivered last week, which is noticed in our news columns. Mr. Rogers, as the Assistant Fittings Superintendent to the Birmingham Corporation Gas Department, is in the very midst of munition making; and he has therefore had ample opportunity of seeing to what a great extent the efforts of the gas-furnace manufacturers have contributed to the output of munitions of war. Lectures such as the one referred to, illustrated by suitable lantern slides, and prepared on popular rather than technical lines, are an excellent means of informing the public of the very useful work that is being performed during war time, not only by the apparatus manufacturers, but by the gas industry generally. It is greatly to be feared that there are many towns in which the nature of this work has hitherto been but imperfectly understood.

The Error of "Electrical Industries."

No opportunity is lost in some electrical quarters of indulging in ill-conditioned snarling at the gas industry, and not only snarling but in circulating false information. The writer of "Gossip" in "Electrical Industries" has been jumping at a conclusion, has erred in doing so, and has given to his readers the erroneous result as positive and reliable information. The matter refers to the appeal made a week or so ago to gas consumers of the country in connection with the extraction from gas of toluol and benzol, without which, and other substances produced by the carbonization of coal in gas-works, this country would by this time have been well out of the war, and in a most ignominious fashion. Our contemporary observes: "The appearance in several newspapers of a uniformly worded patriotic appeal to gas consumers represents one of the cleverest advertising schemes yet undertaken by the British Commercial Gas Association." Again: "No objection can fairly be taken to this publicity effort, except that the innocent public ought to be protected from inferring that the appeal is made to them by the Ministry of Munitions." Still further: "The British Commercial Gas Association is to be congratulated upon its ingenuity in giving a patriotic touch to an appeal which will lead to increased business in gas-fires and gas-cookers." After this guesswork and error, it may likely interest the writer of "Gossip" to learn that the British Commercial Gas Association did not publish the appeal, which had the twofold object of attempting to satisfy consumers that, unless they are using gas for illumination purposes with open flames, they are not suffering any material injury by what is being done, and of pointing out to them that the more gas they use, the greater will be the source of the essentials for high explosives. The expense and the time devoted by gas undertakings to this matter of extracting vital necessaries from gas without compensating return, and the difficulties that have arisen through the inestimable service rendered to the country, have been quite sufficient without being supplemented by the snarlings and the dissemination of untruths by persons whose writing upon the subject show an utter want of appreciation of their responsibility. If the writer in "Electrical Industries" is animated by honourable feelings, he will take the earliest possible opportunity of withdrawing his assertion without any qualification whatever, and there let the matter rest, before he is tempted to say something that may bring him into contact with high authority acting under the Defence of the Realm Act. Much is being done under that spacious and far-reaching Act of which some people have not the slightest knowledge.

A New Coal Contract Clause.

It appears clear that the coalowners have not relinquished the idea of trying to obtain advantage from section 2 of clause 1 of the Price of Coal Limitation Act, which gives the Board of Trade power to raise the standard of 4s. if they are satisfied it would be just to do so in the circumstances. Meantime the coalowners and miners are engaged in the (to them) pleasant occupation of sharing in the excellent proceeds from the selling operations at home and abroad. But it seems that the coalowners are desirous that, if they can get the standard of 4s. raised to 5s., the sellers shall solely enjoy the benefit of the addition. This is what the "Iron and Coal Trades Review" has to say on the subject: "The coal industry continues to be actively employed generally, the demand exceeding the supply, and the top prices allowed by the Limitation Act ruling in the inland trade; while in the export branch they continue to have an upward tendency. It is also reported that collieries in making new contracts are inserting a clause stipulating that in case the 4s. margin under the Limitation Act should be increased to 5s., which may be the case, it is thought, if miners secure another advance in wages, the sellers should have the benefit of the extra 1s. per ton." Readers will note the words: "Which may be the case."

Enemy Trading and Registration of Firms.

There was read a second time in the House of Commons on Friday what is known as the Trading with the Enemy (Amendment) (No. 2) Bill, introduced by the Government. Under the terms of this measure, the Board of Trade are given discretionary power to prohibit the carrying on of any business during the war, or to wind-up any business now conducted in the United Kingdom by persons of enemy nationality or association, or for the benefit of subjects of enemy States. The members were officially assured that the measure will be administered with the single purpose of getting rid of the German element in our trade; and if this be so, it will be a welcome addition to the Statute Book. A report is to be made to the House from time to time as to the progress of operations; and the names of the firms dealt with will be supplied. Another Bill, introduced by Lord Southwark, had for its object to provide for the registration of firms and persons carrying on business under trade names. The full name or names of the person or persons carrying on the business were to be submitted in writing; and there was to be a re-registration, with the prescribed particulars, on any change of trade name. The Board of Trade would, if the Bill became law, have power to fix a fee (not exceeding 5s. for registration); and the Registrar of Joint-Stock Companies would act as the Registrar in connection with the measure. The proposal to read the Bill a second time was, however, negatived.

In the Company World.

From the list which appears on another page of some of the companies which have been either dissolved or struck off the register, it will be seen that the Board of Trade report for the year 1914 on matters within the Companies Acts, 1908 and 1913, has made its appearance. Taking the figures of additions to, and removals from, the register in England and Wales, there is shown a net increase for the twelve months in the number of companies amounting to 2361. This is a substantial augmentation, though far behind the net gain of 3898 recorded for 1913. Companies come, and companies go; for in 1914, while there were no less than 5701 new companies registered, 2017 went into liquidation, and 1323 were removed from the register on the ground that they were no longer carrying on business. The early effects of the war were being felt, inasmuch as the figure of 5701 for new registrations compares with 6871 in 1913, and 6796 in 1912. Excluding those which were in course of liquidation or removal from the register, the number of companies on the register in England and Wales at Dec. 31, 1914, was about 59,000; the total for the United Kingdom being some 66,000. As usual, there were a certain number of companies licensed to be registered with limited liability, but without the addition of the word "Limited" to the name, as associations formed not for purposes of profit; and there is included in the list the Institution of Petroleum Technologists. Change of name was sanctioned by the Board in the case of 347 companies. There were during the year three applications granted for leave to pay interest out of capital during construction; and two of them were made by the Andalusia Water Company and the Seville Water Company. The total number of companies registered in the United Kingdom fell from 7425 in 1913 to 6214 in 1914; the decrease in the nominal capital of the companies registered in the latter as compared with the former year being from £157,186,653 to £113,251,583. The average amount of the nominal capital also fell from £21,169 to £18,225.

Dividend of the Gas Light and Coke Company.

The Secretary (Mr. H. Rayner) intimates that the accounts of the Company for the past half year show that, subject to audit, the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 4s. per cent. per annum, carrying forward to the next account the sum of £446,614 19s. 11d.

South Metropolitan Gas Company's Dividend.

We are informed by the Secretary (Mr. F. M'Leod) that the accounts for the half year ended Dec. 31 show that, subject to audit, the balance to the credit of the net revenue account will enable the Directors to recommend payment of the statutory dividend at the rate of £4 8s. per cent. per annum, carrying forward to the next account the sum of £23,968 3s. 10d.

A Record of Progress.

Well named, with this title, is an illustrated booklet prepared by Messrs. Fletcher, Russell, and Co., of Warrington, to emphasize some facts regarding the works and the history of the firm. In the first place, the reader is taken back to the well-known work of the late Mr. Thomas Fletcher, who as long ago as 1872 began the manufacture of gas apparatus in Museum Street, Warrington. Twenty years later, Messrs. W. & A. C. Russell, ironfounders, of Pendleton, Manchester, who made the greater portion of the castings used by Mr. Fletcher, amalgamated with him, thus forming the present Company. The booklet gives a description of the firm's works as they are now; and with this, and a series of photographs, it is possible to clearly follow the course taken by the raw material from its entrance right through to its finished state. A special department in the works is devoted to the manufacture of furnaces; this being a continuation of the work of Mr. Fletcher, who, it is pointed out, was the first to seriously take in hand the manufacture of small portable furnaces for the melting of iron and other metals. Mr. Fletcher was by profession a dentist; and it was as a hobby that he commenced the manufacture of gas appliances—fitting up his own house with gas cooking and heating plant. These primitive attempts were so successful that a demand arose among his immediate circle of friends for similar appliances; and this led him to commence in a small way the manufacture of articles for the use of gas for domestic purposes. Success came, and with it the works in Museum Street. From these small beginnings arose the present firm, whose name is known wherever gas is used.

PERSONAL.

Mr. ERNEST F. HOOPER has, after 25 years' intimate connection with tar and ammonia products, become associated with Mr. James E. Weyman, as bye-product specialists and chemical engineers, with offices at Pilgrim House, Newcastle-on-Tyne. As a Past-President of the North of England Gas Managers' Association, and a member of the Council of the Society of Chemical Industry, Mr. Hooper is in close touch with gas-works, as well as with the bye-products trade generally; and his long experience will doubtless be of great use in the developments now pending in the opening-out of the industry on broader lines than at present.

At the end of 1915, Mr. JOHN BLACKBURN, Resident Engineer of the Colne Valley Water Company, completed 40½ years' service, having been appointed in 1875. The Company had then only been formed for about two years; and Mr. Blackburn watched the progress of the undertaking to its present dimensions and prosperity. From supplying a small area in Bushey, the Company have gone on growing until they now serve a territory of 76 square miles, including Harrow, Wembley, and district. Mr. Blackburn was originally Assistant Engineer to the Canterbury Water Company. Last week his colleagues presented him with a handsomely illuminated testimonial, recording his valuable services.

Owing to ill-health Mr. J. A. YOUNG has retired from the managership of the Louth Gas Company, and the Directors have voted him a retiring annuity. During about eighteen years that Mr. Young has been at Louth, the consumption of gas has increased by over 60 per cent., and the quality has correspondingly improved. Within the last twelve years the price of gas has been reduced from 3s. 8½d. (net) to less than 3s. (net) per 1000 cubic feet, and further concessions have been made in the price for public lighting, and also to users of gas for motive power. In securing these results, the Directors have had the advice and co-operation of Mr. Young, who comes of a family of gas engineers who have rendered good service in various parts of the country. Mr. LEONARD BIRCHMORE, of Leatherhead, has been appointed, out of 85 applicants, to succeed Mr. Young.

OBITUARY.

The death is announced (as having taken place on Monday last week, at his residence) of Mr. WILLIAM THOMSON, the Chairman of the Cupar Gas Company. The deceased gentleman was in his sixty-seventh year.

The death took place on the 15th inst. of Mr. THOMAS WOLFERSTAN, a well-known Solicitor at Plymouth and for many years one of the Directors of the Plymouth and Stonehouse Gas Company. At the funeral at Walkhampton Church, last Tuesday, Sir Joseph Bellamy, the Chairman, and Mr. T. G. Greek Wills, a Director of the Company, were among the mourners, and the employees of the Company were also represented in considerable numbers.

Mr. THOMAS L. WILLSON, whose death occurred in New York on the 20th ult., was best known in connection with his early work on calcium carbide, for the production of which and the formation from it of acetylene, he took out a number of patents about twenty years ago. In fact, it was while at Spray (N.C), during 1893-94, that he carried on a series of electro-furnace experiments, which finally led to the making of calcium carbide, and more or less accidentally to the discovery that the product, in the course of his experiments, gave off a gas which later on was analyzed and found to be acetylene.

Association of Swedish Gas-Works.

The only co-operation which has hitherto existed between Swedish gas-works has been that the managers and engineers have been personal members of the Swedish Communal Technical Association, which deals, among other matters, with gas-works' questions. At the end of last year, however, a Union of Swedish Gas-Works was organized, where questions concerning the gas industry will in future be discussed. Simultaneously with this general collaboration, the Swedish Gas-Works have put on a firmer basis an organization formed at the end of 1914, to watch over their particular interests. This coalition, entitled the "Svenska Gasverksföreningen," now includes the officials of 24 municipal gas-works, who formerly were able only to temporarily communicate with each other. They have all entered into the new union; and the few remaining works in Sweden are expected very soon to join it. The Council comprises five members; As Chairman, Mr. R. Dahlander, the Manager of the Stockholm Gas-Works; with Mr. R. Blomqvist, the Chief Engineer of the Stockholm works, Mr. A. T. Hall, the Chief Engineer of the Gothenburg works, Mr. H. M. Molin, the Manager of the Malmö works, and Mr. P. E. Aberg, the Engineer of the Helsingborg works. The "Statistics of Swedish Gas-Works" will continue for the present to be prepared, as hitherto, by the Swedish Communal Technical Association, mentioned above.

ELECTRICITY SUPPLY MEMORANDA.

Gas Companies and Electricity Supply.

There are two ways—the right and the wrong—in which people interested in the electricity supply industry can look at the question of gas companies engaging in the more or less pleasant pursuit of supplying electricity in areas in which a service is not already provided. The fact that there is not a supply in existence is *prima facie* evidence that the district has not hitherto proved an attraction for electrical enterprise to either the local authority or to those persons or companies who venture upon the promotion of undertakings in some of the smaller provincial areas. This fact furnishes a good starting place for the discussion of the question of the local gas company entering upon the supply. The electrical people, in their obfuscating hatred of all that has to do with gas, invariably look at the matter from the wrong point of view, and not the right one as to what is economically the best for the district and those who require electricity. The "Electrical Times," for instance, says: "From the electrical point of view, it is not, generally speaking, good business to confer electric-supply powers on people whose interest it is not to exercise those powers." The occasion of this queer utterance was in dealing with a suggestion of the Rugeley Gas Company as to applying for a Provisional Order to confer upon them electricity supply powers, authorization to the making of which application is embraced in their Act of 1900. The Company now think that the district is ripening for an electricity supply, though on a limited scale. They, however, recognize that there is little chance of the Board of Trade considering an Order this side of the end of the war; so they have opened the matter with the District Council in preparation for further movement, and invited their observations on the question of proceeding with a scheme. The "observation" upon the matter of the Chairman of the General Purposes Committee is that "he thought that the proposal was the last thing the Gas Company would have taken up." The remark does not indicate whether he is pleased or disappointed with the Company's action.

Questions of Fact and Economy.

But as to the "Electrical Times" comment. Why should it not be to the interest of gas companies, after they have sunk capital in electrical plant, to do their best to make it earn a profit? If there is any meaning at all in the words of our contemporary, it is that it is to the interest of a gas and electricity company to prosecute their gas business as against their electricity business because there is more money to be made out of the former. Can our contemporary show us an undertaking in this country exercising both gas and electricity supply powers that is engaged in such a piece of lunacy as working to prevent its electricity supply undertaking paying, and operating to the best advantage to both itself and its patrons for electricity? Many of the large electricity supply undertakings of the United States are run by what were originally concerns supplying only gas, and, of course, the secondary products of its manufacture; and no one can say that these companies have not given the electricity business full developing head. What is thought in America on the subject is partially stated in the article on p. 161 of the "Journal" last week; and curiously enough the "Electrical Times" itself gives evidence of the push of combined gas and electrical companies in America, by, in another part of the same issue, referring to what is being done at Rochester (N.Y.) in supplying small electrical accessories, as treated upon in the two succeeding paragraphs. However, in this country the large and favourable areas are under supply; and the districts that are left are neither large nor favourable for electricity supply run independently. At the same time, the gas companies in them cannot afford to share with another undertaking what light, heat, and power business there is going; but it does not matter to the gas company whether the business is secured for gas or electricity generated by gas at holder-cost, or by steam produced by the utilization of coke breeze. It is all a question of economy. Can an electricity undertaking be run more economically by a gas company having land, fuel, and staff—technical, clerical, and outdoor—already available, or by a separate concern with none of these things to its advantage, and which would therefore have to charge more for current in order to compensate for the relative disadvantages? If it can be, then the consumers must benefit. If electricity can be supplied cheaper by a gas undertaking in existence, than by a company starting *de novo*, and having all the additional expenses to meet due to its individual life, then the lower cost must be a factor in helping the progress of the electricity business in that particular area.

Small Accessories.

Under "Cooking and Heating Notes" in the "Electrical Times," an article has appeared calling attention to the value—owing to the diversity of consumption promoted, and the introduction that they give to the use of the heavier class of domestic apparatus—of encouraging and developing the use of such goods as electric irons, coffee-percolators, toasters, table-grills, shaving-pots, and the like. It is remarked that if a consumer is pleased with the results obtained with a table-grill, with a coffee-percolator or with a toaster—"*and he cannot fail to be*"—he is then in a state of mind to listen to a suggestion that he should instal a complete cooker. The words "and he cannot fail to be" find significant comment in the succeeding article, which is headed "Unused Accessories." The writer there says that these accessories sell freely; but, he asks, do they remain long in use after they have been bought? He appears to be overwhelmed with the gravest misgivings. Their novelty, he observes, no doubt causes them to be used regularly at first; but it seems that the inherent qualities of the accessories cannot, on the slightest trouble arising, sustain them from falling into disuse. "If any trouble arises with them, the owner, not regarding them as indispensable, will allow them to continue out of commission. . . . We think that very often he uses a device until it breaks down, or gives trouble through a broken connector or worn-out flexible cord. It is then put away into a cupboard and ultimately forgotten." The very people who so ill-treat these electrical goods are those who, it is supposed, cannot fail to be enamoured of them. We are afraid that in a good many cases, there is mis-fire, and that the advent of trouble does result in the disposal of the broken-down piece of goods among the forgotten trifles to be found in every household. Instances of this sort of thing are known to us. One good lady of our acquaintance has electrical novelties of the kind. They are carefully preserved for use when she wants to make a "show" on occasions when visitors are in the house. When only the members of the family are present, the old, simple, and less expensive ways of doing the same things are followed—generally by the aid of an excellent all-round gas cooker, which stands in the kitchen adjoining the dining-room sturdy and reliable, and capable of supplying all the wants of the family at a most economical rate, and without the slightest trouble.

Their Running Cost.

Returning to the first article, some data are cited as to the cost of running certain of these accessories in a couple of houses in Rochester (N.Y.). This is going a very long way for information. The lesson the figures contain is that, running these domestic accessories off a lighting circuit, as is necessary unless an electric-cooker or electric-fires are in use on a different circuit with current supplied at a lower price, a fairly considerable addition is made by them to the household expenses—if the old system of doing the same things is still available, as it usually is, through being required for other purposes.

—	House.	Flat-Iron.	Percolator.	Washing Machine	Vacuum Cleaner.	Toaster.
Weekly hours of use.	No. 1	2·50	2·75	4·25	2·10	—
	No. 2	2·43	4·38	3·48	1·15	0·05
Power consumption in units . .	No. 1	2·81	1·51	0·935	0·68	—
	No. 2	1·34	1·71	0·80	0·13	1·19
Cost at 4d. per unit	No. 1	11·24d.	6·01d.	3·74d.	2·7d.	—
	No. 2	5·36d.	6·84d.	3·2d.	0·52d.	4·76d.

Our contemporary points out that the weekly revenue from house No. 1 for the accessories, apart from that produced by lighting, was 23·69d., and from house No. 2 20·68d. If these figures be taken as the average for a week throughout the year, the annual revenue would be £5 2s. 8d. and £4 9s. 7d. respectively. These are not negligible sums for most householders, who would see in them a substantial waste to supplement the ordinary fuel bill.

Flat-Rates and Reductions for Quantity.

That the numerous tariffs for electricity, unscientifically devised, and with such false bottoms as the rateable value system, increase in incompatibility with the advance in abnormality, is being evidenced at the present time, and particularly in places without a decent industrial demand. Brighton supplies illustration; and yet we do not think the Corporation Electricity Department has gone to the length of certain other undertakings in the variety of tariffs adopted. In fact, we do not remember that the Engineer and Manager (Mr. John Christie) ever went in for the rateable value system. If he did, it has escaped recollection. However, it went the round of the papers last week that, in addition to a loss of about £7000 revenue by reason of the restrictions on public lighting, the decreased consumption in private houses and business establishments, the management at Brighton has to face an alarming increase in the cost of generation, consequent upon the rise in the price of coal and the inferior quality that is being delivered. A deficit on the year's trading is inevitable; and Mr. Christie, it is stated, reports that next year "the position of the undertaking will be most serious, unless the revenue is substantially increased." We remember a very good dividend having been declared by the Brighton Gas Company at their last half-yearly meeting. Under such perturbing circumstances for the Electricity Department, Mr. Christie recommends a drastic course as the only means of securing alleviation. He proposes, the report states, the abolition of all existing lighting contracts, and the substitution of a flat-rate commencing at 5½d. per unit for the first 1000 units, and decreasing ½d. per unit for each additional 1000 units—the minimum being 3½d. per unit for all consumption over 4000 units. The charge for energy for the tramways, it is suggested, shall be raised from 1·35d. to 1·4d. per unit; but other power contracts are to remain undisturbed. In the extremity of the concern, it takes refuge in the good old-fashioned plan of charging on the flat-rate, with reductions according to quantity taken. There are those artizan dwellings which use an average of only 26—not 1000—units per year, and pay 6d. per unit, including meter charges and lamp renewals, while the other capital and maintenance costs, it is understood, fall upon the Health Committee. These people are surely being treated on preferential terms under the proposed new conditions; and how is Mr. Christie intending to comply with the law in their case? Perhaps he explains in his full report; we cannot tell, seeing that we have not been favoured with a copy. Perhaps it is not considered that we deserve one. The tariff recommendations came before the Town Council last Thursday, but were referred back. There was much discussion; the feeling being that the small consumers were not being fairly treated in being asked to pay 5½d. per unit against 3½d. by the wealthy large ones. There was also some demur to the bulk of the additional revenue being placed upon the private consumer. There was also a proposal that £2000 should be paid from the rates to the Electricity Department on account of the capital loss the undertaking had been put to owing to the street lighting not having been maintained. Some one jocularly asked how much the Council were going to pay the Gas Company, who are also suffering from reduced public lighting. The question was lost in space. Private enterprise has to fight its own battles; municipal enterprise is nursed at the expense of the general ratepayers' pockets.

Summer Deficits and Winter Recuperation. There is a dual interest in the report which Mr. J. Horace Bowden, the Engineer and Manager of the Poplar Borough Council Electricity Department, has presented to his Committee on the results of the working of the second quarter of the present financial year—that is to say, the quarter ending in September. There is, in the first place, good cause for congratulating him upon the net result, and there is, in the second place, cause to compliment him upon stating in black and white a fact which is obvious from the accounts of many electricity undertakings, but is, with beautiful *sang-froid*, invariably denied or else hidden by those interested. Mr. Bowden states: "In former years, and in the case of almost all electrical undertakings, the summer half of the year has invariably shown a large proportional deficit, which is made up in the winter half by the sale of high-priced units for lighting purposes." The burden-bearing high-priced lighting units deserve the everlasting gratitude of the managers of electricity concerns; for without victimizing the lighting consumers they would never have been able to dabble in vicious tariffs as they have done in order to try to attract custom for other purposes. Mr. Bowden is not in favour of the rateable value system; but he prefers (if we recollect correctly) to take the maximum kilowatt demand as the basis for the lump-sum charge, which is supplemented by a small charge per unit. For years he has advocated that, given a scientific system of charging, the summer quarters should show a fair proportion of net profit; and he considers that his opinions are fully vindicated—and no one can gainsay him on the available figures—by the net surplus of the half year (£3358), which is greater than the average of the first twelve whole years of working. Till last year any profit made in the summer quarters was negligible; and in former years a deficit was invariably shown. The net surplus for the last June quarter, however, was £1286; and for the September quarter, £2071—making a total of £3357 for the half year. The corresponding figures for the same periods of 1914 were June £871, and September £1536—making a total of £2407. Therefore, the increase last half year was £950. War conditions did not prevail in the June quarter of 1914; and, taking this into account, the figures last half year are the more noteworthy. The higher coal prices, it has been estimated, affected profits by £2835; the net revenue account suffered by £600 owing to Stepney not taking a stand-by supply; the costs of other materials, pay to dependants of men on active service, and war bonus to the staff account for £436. These three items make a sum of £3871. On top of this a revision of prices represents on the output a reduction of £522. Yet the net surplus is that named. Mr. Bowden has reason in the circumstances to be very pleased with the results, and the Electricity Committee with Mr. Bowden for his management of the concern.

London and Southern Junior Association.—There will be a meeting of the Association at the Westminster Technical Institute next Friday evening, when Mr. E. Stroud, of Holophane, Limited, will read a paper (illustrated by lantern slides) entitled "Modern Illumination as Applied to Gas Lighting." On Feb. 5, members will visit the works at Wandsworth of the Wandsworth, Wimbledon, and Epsom District Gas Company.

Gas or Coke Heated Furnace for Explosive Shell Bands.—The "American Machinist" has given an illustrated description of an automatic shell-band heating furnace, built by the August Muffle Furnaces, Limited, of Halifax. It is stated that eight copper bands can be heated per minute for 4·5-inch high explosive shells, with a consumption of 3 cwt. of gas-coke per twelve hours. The copper bands are fed in the furnace automatically at the top through three slots; and owing to the rocking motion imparted to the furnace, they travel downward in a zig-zag course to the discharge ovens. The furnace can be heated either by solid fuel or by gas to suit requirements. The heat travels upwards around each side of the working chamber without coming into contact with the work itself. All the bands, it is said, receive exactly the same amount of heat treatment.

GAS FOR STUDIO PORTRAIT PHOTOGRAPHY.

In the report of the American Illuminating Engineering Society, published some weeks ago, there was an item to the effect that progress had been made in the production of mantles (for incandescent gas-burners) yielding a more actinic light, and, therefore, specially fitted for photographic purposes, where the chief consideration is obviously the chemical effect of the light upon the sensitive materials. In view of this application of gaslight, it may be of interest to publish the views of one intimately acquainted with photographic conditions, and qualified to point out the directions in which users of gas for the taking of portrait photographs may be most profitably sought.

Of late years, conditions and practice among portrait photographers have undergone very considerable changes. Artificial light for the taking of portraits in the studio has been largely adopted. In many cases, daylight is dispensed with entirely—the photographer thus being enabled to choose a place for his business which is in the heart of a shopping quarter or is upon the ground floor of a building. Usually in such circumstances it is no easy matter to obtain a studio which will be satisfactory with daylight as the illuminant.

Apart from this general adoption of artificial light, either wholly or partially, there has been a considerable change in the class of trade done by photographers. This change has been in the nature of a cleavage of photographers into two principal classes. The one is made up of the high-class men in the west-end of London, and includes, also, leading studios in provincial towns. The second, and by far the larger, class includes those undertaking "cheap" photography. By "cheap" is not implied that the portraits are of a low grade, for many of them are of exceedingly good quality. But the cheapness of photographic materials (at any rate, before the war), coupled with labour-saving methods, has made it possible to produce portraits at extremely low prices on a cash basis. This class of photography developed itself first in large centres, and has spread to smaller towns, and, since the outbreak of the war, has done enormous business in military camps themselves, or in small towns adjacent to the latter. One result of this cleavage has been the squeezing-out to a large extent of the middle-class photographer who, broadly speaking, has been compelled to come into line either with those of the high-class order or with the cheap men. If he has had any real artistic ability, he has cast in his lot with those obtaining high prices for high-grade work. But if his business instincts have been more in evidence than his artistic faculties, he has found it necessary to adapt his practice to that of the cheap photographers, and very likely has bettered himself financially by taking this course.

While the high-class photographers, almost without exception, make some use of artificial light, for the reason that many of their sitters come to them from Court or Society functions, the cheap man finds artificial light practically a necessity to his business—for the reason already mentioned, that it enables him to choose a good business "pitch," and further that it is free from the fluctuations (as regards strength and direction) of daylight, and thus enables him to systematize portrait-making to an extent which allows the work to be done by much less skilled labour. It is among the cheap class of photographers that gas as a source of light may be exploited with every prospect of success.

Hitherto by far the preponderant source of light has been electricity—chiefly electric arcs either of the open or enclosed type. Opinions are pretty equally divided as to which is the better system. In the case of open arcs, the light is generally entirely obtained by reflection, usually from an umbrella-shaped reflector. With enclosed arcs it is usual to employ the light direct, after ample diffusion through semi-transparent screens. Whichever system is employed—and both are adopted by the highest grades of photographers—the crux of the question is that two or three arcs provide a light of very great power which can be damped-down by reflection or diffusion, and still leave plenty of illumination of a highly-diffused kind, but yet of ample power for short exposures.

Other electrical systems which have been used to a very much smaller extent are a battery of six to eight much smaller enclosed arc lamps, as also mercury-vapour tubes. The latter have never found general favour with photographers, on account of the objectionable aspect which the sitters obtain under this illumination. Quite lately the nitrogen bulbs—popularly known as "half-watt" lamps—have come largely into use, though general experience is not yet sufficient to say whether they will displace arc lamps among those who use electric light in studios.

Although electricity has thus been the chief light employed in studio portraiture, it is not to be assumed that photographers are entirely contented with it. In the case of arc lamps, the sudden flickerings and spurtings of the arc are a serious drawback; while nitrogen bulbs give trouble owing to their fluctuations in actinic power, as a result of variation of the load. The actinic effect in these circumstances appears to be very much more affected than the visual effect, with the annoying result that plates may in consequence be under-exposed.

As regards the use of gas, there have hitherto been only two installations upon the market—one consisting of twelve upright incandescent burners staged in front of a bright metal reflector.

This lamp has been marketed by the Kodak Company. In the case of the other installation, twelve Howellite inverted burners are fitted in front of a metallic reflector mounted between a pair of uprights which permit the battery of burners to be raised or lowered. It must be admitted that neither of these installations approaches one or two arc lamps for short exposures or to allow of the photographer taking small groups in the studio.

It may be of value to outline the requirements in a studio lamp—premising that it is used by the "cheap" photographer. The high-grade studios almost invariably exist in centres supplied with electric current, and at the prices which they obtain, the cost of installing and running artificial light is a minor consideration, while their long experience with electric light would make it difficult to wean them to any other, even if it could be shown to be superior. On the other hand, the cheap man is now often in places where there is no electric supply, and his requirements are of a less exacting order.

The chief thing is the actinic or chemical intensity of the light. The visual power obviously is of no importance. The photographer wants a light which at a distance of (say) 6 to 10 feet will illuminate a single full-length figure or a group of (say) three people in such a way that a softly lighted portrait can be taken in a second at most—better in a half or one-quarter second. To give definiteness to this formula, let it be said that the lens will often have an aperture of f/6, although in many studios lenses of f/4 aperture are used—permitting exposures one-half of those with f/6. The plate generally employed is not the most sensitive obtainable, as these are more costly and more difficult to handle. The plate of speed designated as 300 H. & D. is most commonly used—a favourite brand among the cheaper class of photographers being the Kodak "Royal Standard." These particulars are sufficient to enable any maker of a studio gas-lamp to discover for himself whether his apparatus will comply with general working requirements.

Next in importance is facility for switching the light on and off by means of a bye-pass, or some form of distance light-controller. This is particularly necessary with lamps which throw out a considerable amount of heat, since many cheap businesses are run in positively confined quarters.

It is also necessary for means to be provided for placing the lamps as high as possible in the comparatively low rooms which are often used for this class of business. This condition points to the use of inverted burners, and to the avoidance of unnecessary construction above the actual light. Usually, in portrait photography, the light needs to be at least 8 feet from the ground; but it is necessary to have the facility of raising or lowering it smoothly and without physical exertion, in order to deal rapidly with different sitters and to secure different effects. In some cases the lamp may be a fixture in the studio; in others, it requires to be movable.

The colour of the light—presuming that its actinic effect is ample—is a minor point; but there is a psychology of portrait-making of which perhaps the chief element is that the illumination at the time of taking the portrait should present the sitter in a favourable aspect. Often the sitter is accompanied by a friend; and if she (it is usually a she) sees her friend looking at her best in the studio light, she assumes unconsciously that the portrait of herself will, let us say, do her justice. It is a fact that photographers have for this very reason preferred to use open arc lamps rather than the more bluish light of the enclosed arc.

Coming now to the market which exists in this country for portrait lamps in photographic studios, it is estimated that there are from 8000 to 9000 photographic studios in the United Kingdom, of which perhaps 7000 to 8000 come under the category of "cheap." Undoubtedly a great many of these at the present time use only daylight, since many of them are in places where there is no electric supply and have found the gas-lamps hitherto available insufficient for their purpose. On the other hand, a very great number now employ artificial light, when the state of the weather or the time of day renders it necessary to do so; while a still smaller proportion employ artificial light to the exclusion of any other. In considering the outlook for cheap photography in the future, it may be predicted that among the working classes there will be more buyers of cheap photographs than hitherto. Among the philanthropic movements which have arisen in consequence of the war is one organized by the "Y.M.C.A." for the making of portraits of the wives, parents, and children of men with the Army and Navy, either on active service abroad or in camps in this country. Tens of thousands of these photographs have been made by honorary workers at the homes of our men; and hence there is reason to think that the habit of being photographed will receive an impetus among the lower classes of the population. Whether this prediction be justified or not, it is certainly a fact that the present tendency in photography is to seek sitters from the masses of the population, and to offer them photographs in postcard and smaller sizes at prices which are a fraction of those which would have been considered possible a few years ago. Artificial light is the chief necessity in this class of business, since these sitters, drawn from the working classes, have not the opportunity of coming to a studio in the hours of daylight. Hence there is undoubtedly a market for studio portrait lamps in the many smaller towns where electric supply is not available, or even in places where it is—provided a lamp of sufficient power and general suitability could be offered to the photographer and properly fixed by the local gas company at a cost of (say) from £5 to £10.

It is perhaps possible with these facts of photographic conditions before them that one of the makers of high-power burners could devise an installation which would supply the photographer's wants, and even prove a competitor with the electric sources of light. Apparently, one of the chief factors in the case is the provision of a special form of mantle yielding radiations which are of greater chemical activity than those in common use.

GERMAN ILLUMINATING ENGINEERING SOCIETY.

Second Annual Meeting.

The official report of the proceedings at the second annual meeting of this Society, which was held at the Physical-Technical Institute at Charlottenburg on the 23rd of October last, appears in the "Journal für Gasbeleuchtung" for the 8th inst. The following particulars are abstracted from the report.

The attendance at the meeting numbered fifty-three. The President of the Society, Dr. Warburg, of Charlottenburg, made a few opening remarks, in which he referred to the fact that the meeting was the third which the Society had held since the outbreak of war. He said that since the last meeting, the bitterness of the combatants, both those at the front and those behind it, had increased, especially among the enemies of Germany. The purely scientific journals, German, English, and French, however, were free from the war taint; and he therefore was hopeful that when peace was restored ways would be found for the co-operation of all civilized countries on questions of general interest to humanity. Their Society had been founded partly for international intercouse, and the future alone would show whether it would be able again to take up this side of its work.

The Secretary (Dr. Liebenthal, of Charlottenburg) then presented the report of the work of the Society, which he said had been founded on Nov. 2, 1912, and held its first annual meeting—which was also the first general meeting—on Feb. 24, 1913, in Berlin. Three Committees were then appointed to deal respectively with the "Unit of Illuminating Power," "Nomenclature," and "Methods of Photometry." The second annual meeting had been fixed for Sept. 19, 1914, at Nuremberg, but was deferred on account of the war. Ordinary meetings, however, had been held, making seven meetings in all, exclusive of the present annual meeting, at which a total of 21 technical and scientific papers had been read. The Society had become the National Committee for the representation of Germany on the International Committee on Illumination.

The Unit of Light.

The report of the Committee referred to above on the "Unit of Illuminating Power" was presented by Dr. Hagen, of Charlottenburg. The Committee had discussed a report by Dr. Liebenthal dated March 20, 1913, on the "International Unit of Light," which reviewed the position of the question. The Committee agreed unanimously that this report could not as a fact be the subject of a resolution, and that efforts should first be directed to maintaining the unit of light constant, as had been done in France, England, and America. A member of the Committee undertook to get in touch on this point with the people concerned. He had made one report on his inquiry, and would have made another had not the outbreak of war rendered it impossible to pursue the matter. Regarding this report, Dr. Warburg remarked that all were agreed that the present units of light were merely provisional, and that it was desirable that they should be replaced by a rational unit. Such a unit could be based on the radiation in a hollow chamber, and the Reichsanstalt was investigating this question. Two technical Associations had provided the Society with funds for the purpose. If the unit were based on the radiation in a hollow chamber, it would be necessary to fix on a temperature which could be reproduced with certainty. For metallic filament lamps a high temperature must be chosen—viz., about 2000° C. The method of Lummer and Kurlbaum, of reducing the total radiation to a known fraction by means of an absorber, was first employed for fixing the temperature. It had been found that at 2000° C., a rise of 1° in temperature corresponded with an increase of 0·5 per cent. in the light; consequently if the light had to be exact to 0·5 per cent., it must be possible to reproduce the temperature within 1°. This had indeed been found quite possible. Formerly use had been made of the carbon radiator of Leithäuser and Warburg; but it had been necessary to see whether other radiators and measuring instruments would always afford the same result. Another radiator had been obtained, but, as supplied, had been found to be altogether unusable. It had been necessary to break-off the work on account of the dearth of metal.

Nomenclature.

Dr. Strecker, of Berlin, in presenting the report of the Committee on "Nomenclature," said that the Committee had met twice in March, 1914, and had considered the proposals on Nomenclature and Standards put forward by a Committee of the Illuminating Engineering Society of New York, and a report on them which had been prepared by Dr. Liebenthal. After exhaustive deliberation, the members present agreed to certain proposals, which were then communicated to the other members of the Committee, one of whom took exception to them. On account of his objections and the outbreak of war, nothing further had been accomplished; but as finality could be attained only by agreement with other countries, this delay was not, in the circumstances now prevailing, of any moment.

PHOTOMETRY.

Dr. Brodhun, of Charlottenburg, presented the report of the Committee on "Photometric Methods." This Committee originally comprised twenty members, of whom two—Professor Hartmann, of Frankfort, and Dr. Rasehorn, of Berlin—had died. Three questions had been submitted by the Council for the consideration of the Committee.

The first question was the "Estimation of Sources of Light," which involved the establishment of rules by which the light from sources could be determined in the simplest manner. Very divergent views on the matter were held by members of the Committee. Some wished to express the value of all sources by their mean spherical illuminating power; others by the lower hemispherical illuminating power. Others again were of opinion that it was impossible at present to adopt one uniform mode of expression. Finally, however, the Committee agreed on the following points, which had been communicated to the Society at an earlier meeting.

DETERMINING SOURCES OF LIGHT (EXCLUDING SPECIAL LAMPS).

A source of light is to be determined by one of three values—viz.: (1) The mean spherical illuminating power, I_o; (2) the mean lower hemispherical illuminating power, $I_{\smile}$; or (3) the mean horizontal illuminating power, I_h. The result must be so expressed that there can be no doubt which of the three values is meant.

From the purely physical point of view, the mean spherical illuminating power is the most important.

For practical reasons it is frequently not feasible to depart from the determination, which has hitherto been customary, of the mean horizontal illuminating power, or the mean hemispherical illuminating power.

The Committee, therefore, recommend the addition to the figures representing the latter values of the factor for their conversion to the mean spherical illuminating power.

It is not pretended that the adoption of these recommendations will entirely settle the matter; but they constitute a first step towards an understanding.

The second question referred to the "Determination and Measurement of Illumination." The same difficulties presented themselves as with sources of light. Some members wished to adopt the horizontal illumination E_h, others the vertical, E_v, while Dr. F. F. Martens proposed to take into account the mean vertical illumination and the mean illumination from all sides. There were also many difficulties which it would be useful to settle in connection with the measurement of illumination. For instance, it was not immaterial what type of receiving disc was used, or at what height the measurement was made. Herr Bechstein, of Berlin, had carried out investigations for the Committee on the effect of screening the observer in measurements of illumination, and had presented a paper on the subject. The Committee had not yet concluded its deliberations on this point.

The third question was the valuation of motor-car lighting, and experiments on it had been carried out for the Committee by Dr. Löwe, of Messrs. Carl Zeiss, of Jena, under whose chairmanship a Sub-Committee had been formed. The war, however, had broken off this work.

The Chairman thanked the Committee for the work which they had done, and referred especially to the importance of the question of the measurement of sources of light. Each Association had its own Committee, and gas engineers made rules for the testing of gas-burners, and electrical engineers rules for electric lamps, while the Society dealt with sources of light in general, irrespective of their description. Nevertheless, any recommendations made by the Society would have no practical value if they were not accepted by the other Committees; and hence it was desirable that the Society should keep in close touch with the latter. Arrangements had been made for active co-operation with the Society of the General Secretaries of the two large technical Associations—viz., Dr. K. Bunte and Herr G. Dettmar.

OTHER BUSINESS.

Herr Carl Schaller, of Berlin, presented his report as Treasurer on the finances of the Society since its foundation. There were 240 members in 1913, 261 in 1914, and 250 in 1915. The total receipts up to Sept. 30 amounted to about £420, and the total expenses to about £176, leaving a balance in hand of about £244, of which £125 had been invested in German war loans.

Dr. Warburg was re-elected President; and it was decided that the present Council and Committees should continue to act for the duration of the war. It was agreed that the next annual general meeting should be held at Nuremberg.

Two papers were then read—viz., by Dr. Voege, of Hamburg, on "Further Development of Objective Photometry by the Aid of Electric Alkali Cells Sensitive to Light, and their Use for Measuring Illumination," and by Dr. Lummer, of Breslau, on the "Aims and Range of the Art of Lighting, and New Methods of Determining the Temperature of Radiants, especially of the Sun." The last-named paper was discussed by Herr A. Meyer and by Dr. Warburg.

The meeting then terminated.

SIXTY YEARS AGO.

From the "Journal" for January, 1856.

High Prices of Materials.—The existing pressure upon gas companies, arising from the high price of coals, without an equivalent advance in the residual products, has been to some extent mitigated during the past year by the enormous increase in the consumption of gas, consequent upon the high prices of oil and tallow; and, instead of the usual increase of 8 or 10 per cent. per annum, the consumption of 1856 bids fair to exceed that of 1855 by 20 per cent. Unless, therefore, timely provision is made for this increase, such gas-works as are already taxed to the full extent of their powers run the risk of breaking-down in the midst of prosperity. At the present moment, more than ordinary difficulty is experienced in the execution of orders for castings and machinery, in consequence of so many foundries being filled with Government contracts; and many instances came under our observation last year, where engagements entered into for works imperatively required for this winter's service, and which ought to have been completed in August, are still incomplete, in spite of penalties amounting almost to the value of the work undertaken.

The Management of Retorts (A Letter signed "L. T.").—It has often appeared to me that, in theory at least, there is a circumstance connected with the charging of gas-retorts which is incorrect. Thus the entire oven, or setting of five or seven retorts, is charged all at once, and a large mass of cold material in this way projected, as it were, upon the fire at the very time when the heat is most needed. Again, after a time, the whole of its material having become hot, and parted with much of its volatile matter, no longer requires the amount of heat so indispensable in the first instance; but just at this very time, and from this very cause, the heat of the whole setting accumulates and increases, by which, I fear, mischief of another kind ensues. In the beginning, the demand for heat being greater than the supply imperfect carbonization arises, or, in other words, tar is produced. Towards the end, the heat formed exceeds the demand; and then decomposition of gas, or, in other words, carbon is produced. It would be, I think, an interesting inquiry to ascertain the effect of working the retorts singly, at intervals of an hour each; or where this could not be done, of working half the setting at a time on a 2½-hour system of charging, so as to separate the intervals of calorific demand upon the oven into five or two portions respectively. The first system would seem best adapted for Boghead and other cannel coals; the second for common Newcastle coals. There ought theoretically, by this arrangement, to be a larger production of gas of a higher illuminating power, a smaller production of tar, and a less consumption of fuel. Will any of your numerous readers try the matter practically and report upon it?

IRON CARBONYL IN WATER GAS.

American Experiments.

Mr. Leonard M. Liddle, of the Pittsburgh University, states that, in the course of some recent experiments, a constant easily-regulated supply of CO was required; and hydrogen being in no way detrimental, a steel cylinder of compressed water gas was used. The presence of iron in all parts of the apparatus was soon evident, and could not be explained by a mechanical introduction in the slow stream of gas. The presence of $Fe(CO)_5$ seemed to be the most reasonable explanation.

Accordingly, a slow stream of the gas was passed through a glass tube, heated to about 250° C.; and a metallic mirror formed almost instantly. It had the appearance of an antimony mirror, but test showed it to be pure iron. Iron was determined quantitatively by passing a measured volume of the gas through a tube heated in five zones by small flames. Between each zone was a small plug of glass wool. It was found necessary to use these plugs, as the iron is formed as a fine dust, and is unavoidably carried out of the tube. The decomposition of the iron carbonyl was so complete that the first three plugs contained practically all the iron not deposited as mirrors. The iron was dissolved in HCl, oxidized with HNO_3, and determined as Fe_2O_3 gravimetrically. A volume of gas equivalent to 7550 cc., at standard pressure and temperature, gave 0·057 gramme of Fe_2O_3. Calculating the weight of the water gas as about 0·85 gramme per litre, the $Fe(CO)_5$ comprises 2·2 per cent. by weight, but only 0·212 per cent. by volume.

He concludes that water gas compressed in contact with iron should be tested before use in experiments. It has been assumed that the iron carbonyl is $Fe(CO)_5$, though the fact that it was necessarily formed in the absence of light might give $Fe(CO)_7$.

It was stated in the column of "Personals" last week that Lieut. CLIVE GRIFFIN (only son of Mr. William Griffin, the Secretary and General Manager of the Folkestone Gas Company) had been awarded the Military Cross for his services with the R.F.A. We have since learned that Lieut. Griffin has more than once distinguished himself; but the exploit which won for him the Military Cross was the unloading of an ammunition waggon which had caught fire. This work was successfully carried out, at great risk to the gallant young officer.

A FORWARD POLICY AT TUNBRIDGE WELLS.

Gas Company's New Offices and Show-Rooms.

If, as we are told, " 'tis not in mortals to command success," those responsible for the administration of the affairs of the Tunbridge Wells Gas Company have evidently done more—they have deserved it. And the history of the undertaking, to which reference will presently be made, shows how amply their efforts have been rewarded. Beginning in a small way, the business has never ceased to grow; and the policy pursued has proved no less satisfactory to the consumers than to the shareholders. That this growth will continue for many years to come—whatever may be the temporary effect of prevailing abnormal conditions—must be the settled conviction of anyone who informs himself as to what is being done. Such an opportunity occurred last week, in connection with the opening of new offices and show-rooms; and the following notes of what was gathered on that occasion will indicate how well the community are being served, and how strong is the determination of the Board, and those who are associated with the distribution side, to keep well to the forefront the claims of the gas which is sent out at so reasonable a price from the works.

It was on Wednesday afternoon that the opening of the new offices and show-rooms took place; there being present at the ceremony some 170 guests, including many influential professional and business men living in the locality—members of the Town Council, doctors, architects, builders, and ironmongers—as also their wives. While enjoying the music of an excellent orchestra, an inspection of the new arrangements was made; and this was followed by afternoon tea, served in the Board-room. On all sides expressions of well-merited admiration and congratulation were heard, which must have been extremely gratifying to the recipients.

Early History of the Company.

Before referring in detail to the new premises, it may not be uninteresting to sketch briefly the early history of the Company, and the events which have led to the new developments. Originally, the town was supplied with gas by a private individual named Berry; but as great complaints were made with regard both to the adequacy of the supply and the quality of the gas, a public meeting was called on Nov. 1, 1842. At this meeting over a hundred persons were present, which was a large gathering at that time; and the outcome was the formation of a Committee to see what could be done to improve matters. The then existing works were sold to the Committee for £3700; and the Company was formed in 1843, with a capital of £5000, to take over the control of the gas supply. At the present time, the capital is about £191,000.

This is a big increase; but the growth of the gas consumption has been far greater in proportion. In the year 1844, which was the first completed year of the Company, the gas was supplied at the rate of 11s. per 1000 cubic feet; and the receipts from the sale of it amounted to not quite £1700, representing nearly 3,000,000 cubic feet. Compared with these figures, in 1914, the period covered by the last-published accounts of the Company, the price charged to the consumers in Tunbridge Wells was 2s. 6d. per 1000 cubic feet, and the receipts from the sale of gas amounted to £43,550, representing a consumption of 353,637,000 cubic feet. The prices quoted show how greatly to the benefit of the consumers the progress of the Company has been. It is true that, in consequence of the effects produced by the war, it has so far been found necessary to increase the price of gas 2d. beyond the low rate of 2s. 6d. per 1000 cubic feet previously existing—making it 2s. 8d.; but this, of course, has been quite unavoidable.

The Forward Policy.

Looked at in every way, the career of the Company has been one of continuous success; and this is the natural outcome of the progressive policy adopted by the Board. The interests of the consumers have always been carefully studied. In 1893, the prepayment system was adopted for the purpose of supplying gas to the smaller houses; and this convenient method has been largely taken advantage of by the inhabitants. Then some years ago the incandescent burner maintenance system was adopted; and a further subsequent development in this direction has been in the arranging of periodical visits to consumers in connection with the proper upkeep of gas fires and cookers; the Board rightly believing in the principle of approaching the consumers and attending to their wants, in preference to leaving them to grumble or make complaints at the gas office. This is the proper spirit; for certainly a satisfied consumer more than repays any slight extra trouble that may in this way be incurred. And while thus looking after the consumers, it must be added that the Board have by no means lost sight of the interests of the employees; the Company having been one of the first twelve in England to adopt the co-partnership system, thereby inducing the men to take a more intelligent interest in their work, and enabling them to share in the many benefits to be obtained by economical working in time and material.

The Veteran Chairman.

One of the interesting features of last week's function was the sketch of the Company's history as given by the veteran Chairman, Alderman W. H. Delves, J.P., who, in receiving the visitors, was supported by the other members of the Board (Messrs. R. Pelton, J.P., H. A. Beeching, William Stamford, Egbert Cronk, W. T. Trollope, Philip Ellis, and H. Thorpe), the Secretary (Mr. Charles F. Catt, F.C.I.S.), and the Engineer (Mr. Andrew Dougall, M.Inst.C.E.). To give such historical facts no one could have been better qualified than was Alderman Delves; for he first joined the Board in the year 1859, and has occupied the chair since 1887. Though well over eighty years of age, he is as keen and enthusiastic as ever; and with him at the helm, the steering of the Company's course is in thoroughly capable hands. While speaking of the length of time during which he has presided over the affairs of the undertaking, it may be mentioned that the Company has been exceedingly fortunate in this respect, inasmuch as since its formation in 1843 there have been only three Chairmen—Mr. Joseph Delves from 1843 to 1851, Mr. E. M. Hunter from 1851 until his death in 1887, and since that time the present Chairman.

After extending to the guests, on behalf of the Board, a hearty welcome to the new premises, Alderman Delves said he thought they would all agree that great credit was due to the Architect for the skilful manner in which he had made the most of his opportunities, and of the limited space at disposal. He then drew attention to a first-rate collection of the products of coal tar which was on view, partly loaned from the local Technical Institute, and partly derived from the Company's own works. From this, among other things, it was possible to judge of the similarity between natural indigo and that which has its origin in coal tar. The Chairman touched upon the importance of this exhibit from a patriotic point of view, and referred to an article which has recently appeared in the Press asking people as far as possible to use gas in place of raw coal, because of the toluol that will thereby become available for the manufacture of high explosives for our fighting forces. In the case of their own Company, he said, the coal which they carbonized in a day was sufficient to fill 250 3-inch shells. When they remembered how many gas undertakings there were in the country—many of them much larger than that at Tunbridge Wells—they would realize what an important position the industry occupied in connection with the manufacture of high explosives. Coming to the question of the slight increase which it had been found imperative to make in the price of gas, the Chairman showed how small an amount 2d. per 1000 cubic feet was, under all the circumstances, to add to the charge, and how well it compared with the advances necessitated in London and in many of their neighbouring towns. He told them that in 1914, just before war was declared, the Tunbridge Wells Company entered into a contract for their year's supply of coal at 18s. 7d. per ton, while the 1915 contract was fixed at 29s.—a rise of nearly 11s. per ton. This made a difference on the quantity of coal carbonized of some £12,000 a year; so that the rise of 2d. per 1000 cubic feet in the price of gas was very trifling when compared with the increased cost of coal. They would all do their level-best to carry on without a further increase in the charge; but he was not at the present moment very sanguine about being able to do so. When thinking over the matter, the consumers should bear in mind that, as the Company were under the sliding-scale, which meant that the shareholders' dividends were governed by the price of gas, the Board did not raise the charge for gas from mere fancy, but because they were impelled by stern necessity to do so.

The Mayor (Mr. C. W. Emson) then, at the request of the Chairman, formally declared the building open, and expressed

his great pleasure in doing so. He said the facts stated by the Chairman showed how efficiently the affairs of the Company were managed. Starting in very small circumstances, they saw to what dimensions it had grown; and it was still progressing. It had a worthy opponent in electricity in the town; but in spite of this competition with the municipal undertaking—which was a perfectly fair and reasonable competition—both concerns had progressed. The Gas Company not only had initiative, but they possessed the faculty of altering their policy to suit the changed condition of the times. The greatest credit was due to those concerned; and the town had every reason to be proud of the undertaking. Seeing how long the present Chairman had been in office, much of the success which the Company had attained must have been due to him and to his colleagues. On his own behalf, and on behalf of the town, he wished continued prosperity to the Company, and long life to the Chairman.

The New Offices and Show-Rooms.

The offices of the Company were originally at the Secretary's residence; but in 1876 premises at No. 44, High Street were taken for the purposes of the business—the old office being altered and adapted to meet the varying conditions from year to year. In course of time, however, the expansion of the business necessitated the adoption of a more radical scheme than this; and it was decided to rebuild on the original site, which occupies an excellent position in the centre of the main thoroughfare of the town, midway between the two railway stations. Temporary premises were secured at the Pantiles for offices and show-rooms; and there the business has been carried on during the re-building. The Architect for the building was Mr. Egbert Cronk, who is also one of the Directors of the Company, being thus doubly qualified for his task; and the contract for the work was given to Messrs. Thomas Bates and Sons, in September, 1914. The building itself is of red brick, and has stone facings—the lower portion of Portland and the upper Bath stone. The front of the premises is of classic design, and is surmounted at top by a balustrade, with a pediment in the centre having a carved stone date panel. The whole forms an imposing building. The outside lighting—when it is permissible to indulge in this luxury—will be by two 10-light and one 12-light Sugg "Littleton" lamps, of a total lighting power of over 3000 candles; but the control is so arranged that the centre lamp can be partly shut off, leaving only three burners alight, when there would be an illumination for the benefit of the thoroughfare throughout the night of some 270 candles. It may here be mentioned that the authorities of the Electricity Department had the "courtesy" in 1895 to place a large electric arc lamp immediately facing the front door of the old premises, within some feet of the entrance; but by arrangement with the town authorities this has now been removed—subsequent on an offer from the Company to provide an equivalent light for the public

during the usual lighting hours, reducing at night time, similar to the electric arc lamps. On the ground floor, there is a handsome oak and plate glass double front, with central entrance to the show-rooms and offices.

The show-room, which has a polished wood block floor, is 30 feet wide, with 14 feet pitch, thus allowing of a display of the different goods to the best advantage. On entering, the visitor is faced by a large glass case filled with the more elaborate kinds of silk and beaded shades, and on either side are square oak pillars, to the four sides of which gas-brackets—but not too many of them—are attached. From the ceiling are suspended a varied selection of gas-pendants, for direct and semi-indirect lighting, some live, and others attached by a special form of fitting which allows of their instant removal when required—and, again, there are not too many of them. In fact, in the entire fitting-up of the show-room one sees the strongest evidence of a wise determination to avoid the error of over-crowding. In the windows, gas-fires and cookers are shown, as they are also, in all their latest styles and sizes, round the room; smaller, but equally desirable, gas-consuming devices being placed on a shelf at a convenient height. On one side, too, there are a fitted porcelain bath and a lavatory basin, with a complete "Ironclad" water-heating installation and geyser, both in action. Past this tempting array—further evidence of good design—the consumer has to wend his or her way when wishful to pay an account in the clerks' office, which is really a continuation of the show-room, at the rear, the combined depth of this office and the show-room being 68 feet. Both show-room and the offices are well lighted and ventilated; and the wainscot oak used for the woodwork harmonizes exceedingly well with the contents.

The Secretary's office is situated in the rear of the clerks' office, and is approached, for convenience of access, either from the general office or by a corridor leading from the show-room, out of which suitable lavatory and cloak-room accommodation is provided. The engineer's office is also at the end of the corridor. A feature of the show-room is a massive oak staircase (with large mullioned and lead-light glazed window) leading from it to the upper floor, where there is a committee-room and a lofty board-room, about 31 feet by 19 feet, with chimney-piece and woodwork in oak, coloured walls, and deep frieze, below which are hung portraits of the late Mr. E. M. Hunter (at one time Chairman), Mr. W. H. Delves, J.P., the present Chairman, the late Mr. R. P. Spice (former Consulting Engineer), Mr. T. Fox Simpson (late Solicitor to the Company), and the late Mr. John Read (who preceded Mr. Catt as Secretary). The portrait of Alderman Delves, it may be added, was presented to him by the Directors, Engineer, and Secretary, in February, 1909, on the completion of his fifty years as a Director and twenty-one years as Chairman. Other objects of interest exhibited in this room is a replica of the shield from the Tunbridge Wells Tradesmen's Association for the best illuminated and decorated premises during Cricket Week in 1912, and the trowel presented by Mr. Spice to Mr. Hunter, who was at that time Chairman, for the laying of the foundation stone of the works which were erected in 1878. The lighting of the board-room is by a Sugg eight-burner ventilating light, with obscuring cut-glass bowl; the lamp, with the globe, giving an effective illuminating power of 400 candles. The control of the lighting throughout is on the bye-pass switch system, operated by means of a lever-cock.

At the back of the building, on the first floor, and approached by a separate side-entrance and staircase, are convenient rooms forming a self-contained flat, which will be occupied by the Chief Inspector of the Distribution Department. The whole of the basement of the premises has been utilized for the carrying-on of the work of the Company in the matter of fittings and maintenance, and for meter-testing. A roomy space provided for receiving and packing is entered by large doors from the side-passage; and the gas-meter testing room, workshops with benches and fitted tools, stores and issue departments for the varied fittings required, and a suitable office for the Chief Inspector, all combine to form a fully-equipped workshop well able to keep pace with modern requirements, and arranged to prevent all avoidable confusion.

In view of the fact that this article deals solely with the distribution side of the business of the Tunbridge Wells Gas Company, it would be unfair to conclude it without reference to the services rendered to this branch of the undertaking by Mr. Charles F. Catt, as Secretary. He has been with the Company for over thirty years; and it is no more than an act of justice to ascribe to his initiative and business acumen much of the progress that has been a pleasure here to record.

[The photographs reproduced are from the Studio of Mr. Harold H. Camburn, of Tunbridge Wells.]

CHICAGO AND A CALORIFIC STANDARD.

Prospective New Gas Plant.

A tempting offer has been laid before the City Council by the People's Gas Company of Chicago, provided that the authority will agree to a calorific standard for the gas; the Directors declaring that, if the city is willing to co-operate with the Company by eliminating the "unwise high candle power requirement," this will allow the Company an opportunity to erect a coal-gas plant on property heretofore acquired for the purpose, and will thereby promote the possibility of future greater reductions in the price of gas. The erection of such a plant, with the regular extension of the Company's distribution system, would, it is stated, necessitate an expenditure by the Company of not less than $14,000,000 within the next three years.

When making this offer, the Board pointed out that for many years there has been a succession of controversies between the city of Chicago and the Company on the subject of rates to be charged to consumers. These controversies have never satisfactorily accomplished their object, but have caused much expense both to the city and to the Company and its predecessors. It is the Board's desire to bring the matter to a conclusion; and they believe this can be done by negotiation far more promptly and satisfactorily than by continued litigation. This being so, they suggested a conference between the parties, with a view of determining whether a schedule of rates can be evolved which will be mutually satisfactory. What the Directors would like to see established is a system of graduated rates which would tend to encourage the use of gas, not only for domestic purposes, but also by local industries, both small and large. Such a scale, they think, could be adjusted fairly and reasonably so as to result in reducing from time to time the selling price of gas, through reduction in the cost of its manufacture.

On the question of the standard, the Directors remarked that the constantly increasing price of oil, which is the factor of greatest expense in the manufacture of water gas now supplied by the Company, must inevitably call for an increase in the price of gas in the near future, unless the conditions surrounding its manufacture shall be so changed as to enable the Company to avoid the increasing cost. Gas in Chicago is now supplied according to a prescribed standard of candle power—the "highest to be found in any large city in the country." They believe this standard of quality to be unsound. A change of standard to a heat unit basis would permit the manufacture of gas without the use of oil, and would thus place the Company in a position to lower the cost and price of their product. Only a negligible percentage of the gas now consumed in Chicago is used through open-flame burners; and from the standpoint of efficiency and economy to the consumers, these old burners ought to be entirely discarded. They are as much out of date and as wasteful as the old type carbon filament lamp now is in electric lighting. The Public Utilities Commissions of Illinois, Indiana, Wisconsin, Pennsylvania, Washington, Oregon, New Hampshire, Missouri, Nevada, and the District of Columbia, after exhaustive study of the question, have adopted the heat unit standard; and other States are considering the change.

According to the "Gas Record" [Chicago] the public received the Company's suggestion very favourably; and it is believed that negotiations will proceed rapidly.

Mr. H. Lawrence Cripps, son of the late Mr. Henry W. Cripps, Q.C., lately a partner in the firm of Messrs. Dyson and Co., Solicitors and Parliamentary Agents, and at one time an Alderman of the London County Council, left estate of the gross value of £46,786. The will of Dr. Robert Sharp, who was Vice-Chairman of the Coatbridge Gas Company, has been proved at £31,853.

Miss Constance Crookenden, daughter of the late Mr. I. A. Crookenden, for many years Secretary of the Phœnix Gas Company, at the investiture held by the King last Saturday week, had conferred upon her the decoration of the Royal Red Cross. Trained at St. Thomas's Hospital, Miss Crookenden was for some time Matron of the Crays Valley Hospital and is now Matron of the Addenbrooke Hospital, Cambridge, and Principal Matron of the First Eastern General Hospital, at Cambridge.

NEW FEATURES AT THE DAVIS GAS EXHIBITION SALONS.

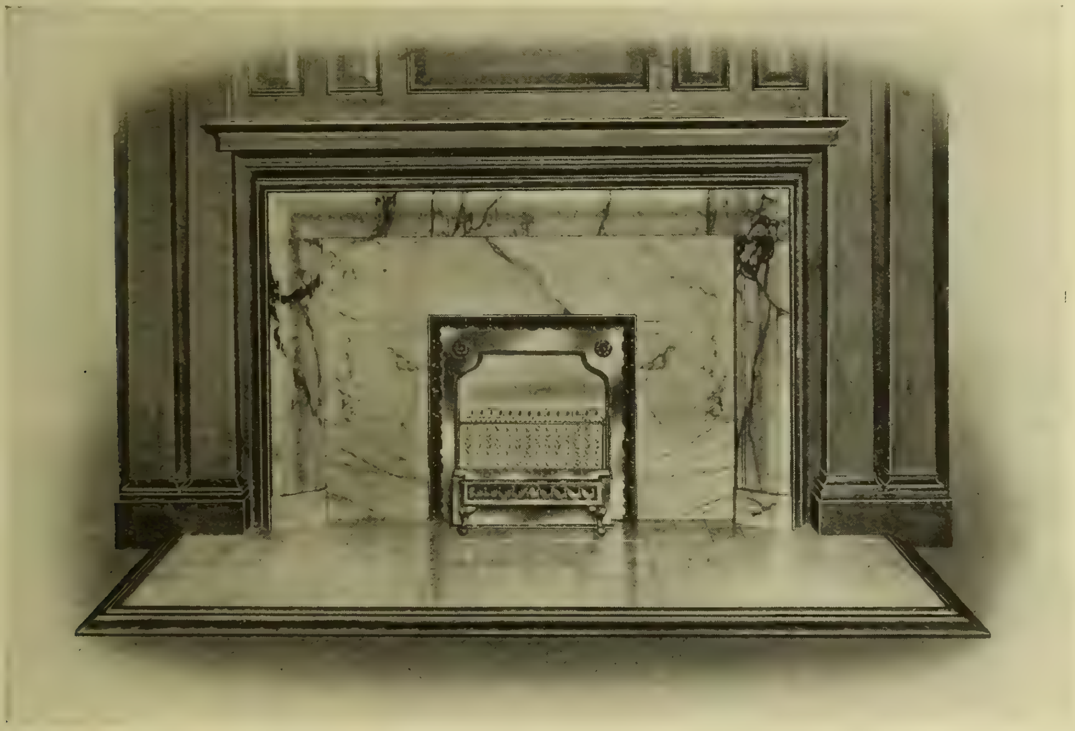
Passing through Oxford Street the other day, the writer took the opportunity of repeating the pleasure of a previous occasion by having a walk through the Gas Exhibition Salons of the Davis Gas-Stove Company. It is not only a pleasure to visit these unrivalled gas show-rooms, designed and materialized by a robust enterprise, but there is perennial interest in them. It is rather more than eighteen months since the salons were opened; and the scheme has since developed into one of comprehensive perfection in respect of types, fitting, and display. Those responsible for this piece of excellent work have very definite aims and objects here. The highest standard that can be reached in any one respect is the standard that is maintained, and that it is intended shall be maintained. One result of this is that the place looks as fresh to-day as it did in those early days when order emerged from the chaos of construction, fitting-up, and furnishing. Everything looks clean and smart. There is no neglect; for it is a fundamental and closely observed maxim that a gas show-room should never be allowed to deteriorate, but if anything, like wine, should improve by the keeping, through having recourse not only to refinement, permanent cleanliness and orderliness, but to the improvements in types of appliances developed from time to time. A nice place attracts a lot of nice people; and that is what is being done at the Exhibition Salons—the "nice" being in this instance synonymous with "influential."

Among the people attracted are architects; and their souls are delighted, and their choice quickened, by seeing the fires in surroundings that appeal to their professional instincts. It is no use showing them a new type gas-fire in an old-fashioned, drab-looking mantel and background. They want to see the gas-fires framed in specimens of the things that they would themselves suggest to their clients as the materialization of the latest ideals in mantels; and the pleasure of the demonstration of actual appearance is transferred to their clients, by sending them along to the place where they can appreciate exactly what a gas-fire of a certain type will look like in various modern designs of surroundings and in the modern tastes in materials. Lately, there have been at the salons several changes in the architectural features of the fire surrounds, in order that the fires may be inspected in the latest styles, and in order, too, that there may be a good diversity in contrasts.

Change in display is observed in the entrance windows; and in most of the neat divisioned fireplaces in the main salon—divisioned so that the eye is confined to the inspection of one thing at a time—the latest types of the firm's fires are fixed. Always admired by visitors is the "ingle bay"—it is one of the chief of the many features of the salons. This oak-wainscotted room has an oak mantelpiece, with Pavanazzo marble architrave and panels, and a Hopton tiled hearth; and in this is set one of the firm's very latest types of gas-fires. It is the "Georgian;" and the artist has been skilfully at work upon developing the delicate embellishments. The photograph portrays it better than words. But it is a fire that is worthy of its setting; and the setting is worthy of it. Flush fitted in the setting, with its 18-inch front—a good broad, genial faced fire for large apartments—it will here make good its claims to consideration before next heating season comes round, when it is to be placed on the market. Just outside the "ingle bay," set in a slantwise mantel, is the firm's new "Diana" fire. It is a moderate priced fire for all situations in which a well-finished serviceable fire is needed. It has a well disposed canopy, burns silently, and yet, unlike some silent fires, the columnar fuel is beautifully incandescent in its length. "Diana" has a prepossessing appearance; and it is not surprising to learn she is in high favour.

Passing to the divisioned recesses, in which mantelpieces and surroundings of high character in design and material are found, with fires in them of various patterns and for different situations, we may refer to samples of the new work, which demonstrate the applicability of gas-fires to the best styles of work in "fireplaces." Here we have a very pretty thing in marble, which obtains its name of "Dove" from its delicate grey tint. Dove surroundings and hearth and Dove and statuary boxed moulded slips, with an "Adam" interior fire, form a combination that is very choice. Here, too, we have the "Pandora" nestling in a neat grey tiled surround, with curved back. The "Jacobean" fire shows its capacity for harmonizing with a nice setting of peacock blue tiles with Lunel slips. Another new type of surround is given by red crystallized tiles to the "Adapta" fire. This has a Jacobean mantel, and, with a semi-circular bronze curb, it has a very artistic appearance. There is also to be seen a very pretty effect with a "Georgian" fire similar to the one in the "ingle bay," but with an earlier type of trivet. This fire has a mantel and surround of pale green tiles. We must leave, with the reference to samples only, the excellent work and demonstration of the fitness of the gas-fire to any location and surroundings.

We pass down to the extensive basement. When last making an inspection, the scheme was not completed in this part of the salons. But it is now; and the architect, gas engineer, gas salesman, private individual, and manufacturer can each and all find practical exposition here, whether it be for fitting up the largest hotel or the cottage with gas-heated cooking arrangements of all kinds, or whether it be for fitting up the large business establishment, the mansion, or the houses in Suburbia with hot-water circulating boilers and adjuncts in connection with the coal range, or independently of it, or in conjunction with a gas-range. Blue prints hang alongside each showing the arrangement of all the connections, so that there is good instruction here for those who are contemplating adoption. Radiators are also shown fitted up to the hot-water system. Here also are most inviting bath rooms. Further along we come to strong, practical looking contributions from the firm's industrial furnace department. Here, too, are fires set in more modest surroundings than in the main salon, and a central display of the entire range of Davis gas-cookers. The large and diversified range of domestic gas-heated appliances seen here transfers the thoughts to the spacious foundry and shops at Luton from which all these representatives of the firm's extensive manufacturing operations have emerged.



DAVIS "GEORGIAN" GAS INTERIOR IN THE OAK-PANELLED INGLE BAY.

North British Association Motor Ambulance.—The North British Association of Gas Managers have been collecting subscriptions with the object of presenting the Red Cross Society with a motor ambulance. The vehicle has now been ordered, and is to be handed over to the Society on the 2nd prox.

EXTERNALLY HEATED GAS-OVENS.

The Question of Gas Consumption—Experimental and Independent Experiences with the Potterton "Sealed" Oven.

EXPERIENCE with externally heated gas-ovens is growing; and this experience is of a very satisfactory order. But there is something revolutionary in the idea; and revolutionary suggestions are apt to give rise to scepticism. But if the theories and the practices of the past are never to be subject to change, we should be a motionless people, and progress would never be achieved. This being so, when anything new presents itself, it is well, while we may be doubtful, to reserve condemnation until practical experience offers its support, or if it proves that our fancies bred of inexperience are wrong, then there will be gratification in having held one's peace.

Mr. Thomas Potterton, of the Cavendish Works, Balham, S.W., introduced some years ago his "Sealed" gas-oven with the gas-jets located on the outside, and the heat circulating, by regulated means, round the oven in the chamber furnished by it and the outer casing. Messrs. Fletcher, Russell, and Co., Limited, introduced, quite a distance of time ago now, the "Langham" hotel gas-oven, also externally heated, which is a piece of cooking plant on the large scale that has stood the test of time, and continues to give great satisfaction. Miss Helen Edden has designed a domestic oven with external heating, as described in the "JOURNAL" for Nov. 23, p. 429. There have been one or two other patentees; but their productions have not been placed on the market. Mr. Potterton has not made any particular effort to push his externally heated cooker. But it has been adopted; and in influential quarters it is pushing itself, and some excellent practical experience has accrued from its use. There are, however, sceptics as to any practicability or advantage over the ordinary form of gas-cooker; and the chief doubt that exists is as to whether there is any economy in regard to the consumption of gas. The statement of inexperience is that there is no such economy; the statement of experience is that there is. We have to thank Mr. Potterton for having placed at our disposal some figures not only derived experimentally, but from large scale work and independently; and these should conclusively set the question at rest.

The statement of the results realized with externally gas-heated ovens may be prefaced by saying that there are representatives in general use at the National School of Cookery, Buckingham Palace Road, S.W., as well as in private houses and hotels. But the greatest and most significant success is that the Aerated Bread Company, after making prolonged tests with an externally heated gas-cooker in comparison with an ordinary internally heated one, are now fitting the former at their new branches, as well as in existing depôts. The competence of the technical staff of the Aerated Bread Company for ascertaining the apparatus best suited, commercially and efficiently, to their large requirements will hardly be questioned; and, as stated, the result is in favour of the externally heated oven. This being so, this type of oven cannot be definitely dismissed as being of no account by people who are without experience of it, or who, being sceptical, make all sorts of random statements concerning it. Besides, the Aerated Bread Company, the Principal of the National School of Cookery pronounces the oven as being "very satisfactory;" and a letter from a hotel proprietor at Folkestone expresses the pleasure experienced in using the oven, and declares that it is a great improvement on the old style. He also mentions that the oven retains heat for a long time after the gas has been turned off. His view is that some steps should be taken to make the cooker better known among the public. This may savour somewhat of advertisement for a special form of cooker construction. It is not intended to be so. The intention is to show that there has been independent practical experience of a new principle in construction and method; and that this practical experience speaks very highly of the external heating of ovens.

TESTS BY THE AERATED BREAD COMPANY COOKING STAFF.

We will first of all give the results of tests made by the cooking staff of the Aerated Bread Company. Even the registrations of the gas consumption were made by a gas inspector of the Company, so that the tests all through may be taken as being wholly independent and the results reliable.

Test Made at the London Bridge Depôt, May 27, 1914.

Ordinary Oven.	*Potterton's Patent No. 3 "Sealed" Oven (Externally Heated).*
Gas lighted:	Gas lighted:
8·50	8·50
9.5 Beef (25 lbs.) placed in oven—Ribs, 18 lbs.; Buttock, 7 lbs.	9·5 Ribs of beef placed in oven. Two pieces weighing 21 lbs. 12 oz.
11.0 Buttock taken out.	
12.0 Ribs taken out.	12.0 Meat taken out.
Weight of meat after cooking: 16 lbs. 14 oz.	Weight of meat after cooking: 16 lbs. 10 oz.
Fat . . 2 „ 14 „	Fat . . 2 „ 0 „
Loss in cooking . . 8 lbs. 2 oz.	Loss in cooking . . 5 lbs. 2 oz.
Gas used . . . . 98 cub. ft.	Gas used . . . . 59 cub. ft.
Cooking space in oven: 23 in. by 18 in. by 20 in.	Cooking space in oven: 23 in. by 18 in. by 18 in.

In the foregoing it will be remarked that, with the externally heated cooker, for doing practically the same amount of work, the consumption of gas was only 59 cubic feet compared with 98 cubic feet with the ordinary form of oven. Now to a Company having a large number of depôts, and extensive demands at each depôt for cooked articles, and for six days in the week, such a saving in gas consumption on a single test represents a very considerable sum annually. To arrive at this sum, there would have to be multiplication again and again. The test does not give much room for scepticism; and if there were any doubt on the Company's part, they would not be taking the course they are doing in extensively adopting externally heated ovens.

The second point, as to the loss of weight of meat (a saving being shown by the externally heated oven), is an interesting one, particularly in view of the claims of the electric-cooker people. Supplementing the figures on this point in the foregoing table are others from subsequent tests; and these we are able to also reproduce:

Special Tests on Losses in Weight of Meat Cooked in Ordinary Oven and Potterton's "Sealed" (Externally Heated) Oven.

Ordinary Oven.					*Potterton's Patent No. 3 "Sealed" Oven (Externally Heated).*				
			Loss.					Loss.	
	Lbs.	Oz.	Lbs.	Oz.		Lbs.	Oz.	Lbs.	Oz.
May 29, 1914.									
One piece ribs of beef	16	8			Two pieces ribs of beef—				
					One piece . .	17	8		
After cooking. .	12	10	3	14	After cooking .	14	2	3	6
					One piece . .	15	8		
					After cooking .	12	12	2	12
Fat	1	4			Fat from both joints . . .	1	12		
June 3.									
Ribs of beef . .	21	5			Ribs of beef . .	21	5		
After cooking .	14	2	7	3	After cooking. .	14	9	6	11
Fat	3	7			Fat	3	6		
Gas used, 95 c. ft.					Gas used, 54 c. ft.				
June 4.									
Two legs of mutton . . .	20	11			Two legs of mutton . . .	20	12		
After cooking. .	13	4	7	7	After cooking. .	14	7	6	5
Fat	3	2			Fat	2	14		
Gas used, 95 c. ft.					Gas used, 59 c. ft.				

Again smaller losses in weight are shown by these trials.

In such an enterprise as the Aerated Bread Company, the heating of water is a matter of considerable moment. It must be expeditiously and cheaply heated; and, though this has nothing to do with the question of the economic advantages of the use of externally heated gas-ovens, it has passing interest as showing, by a change of system, a considerable saving in cost.

Water Heating for Washing-Up Purposes.

By the "A. B. C" Steam Apparatus.	*Potterton's Water Heating System.*
Water . . . . . 69° Fahr.	Water . . . . . 69° Fahr.
40 cubic feet of gas used.	40 cubic feet of gas used.
12½ gallons water drawn into sink, 125° in bulk.	12½ gallons water drawn into sink, 137° in bulk.
Hottest water at tap, 137° at commencement.	Hottest water at tap, 150° at commencement.
Temperature after drawing 12½ gallons, 124°.	Temperature after drawing 12½ gallons, 140°.
13 cubic feet of gas used while drawing water.	2 cubic feet of gas used while drawing water.
Total gas consumed, 53 cubic feet.	Total gas consumed, 42 cubic feet.
Five days' consumption, 6015 cubic feet.	Five days' consumption, 4252 cubic feet.

The next tables supply the results of temperature tests made on the three following constructions of oven:

TABLE I.—Ordinary gas-oven.

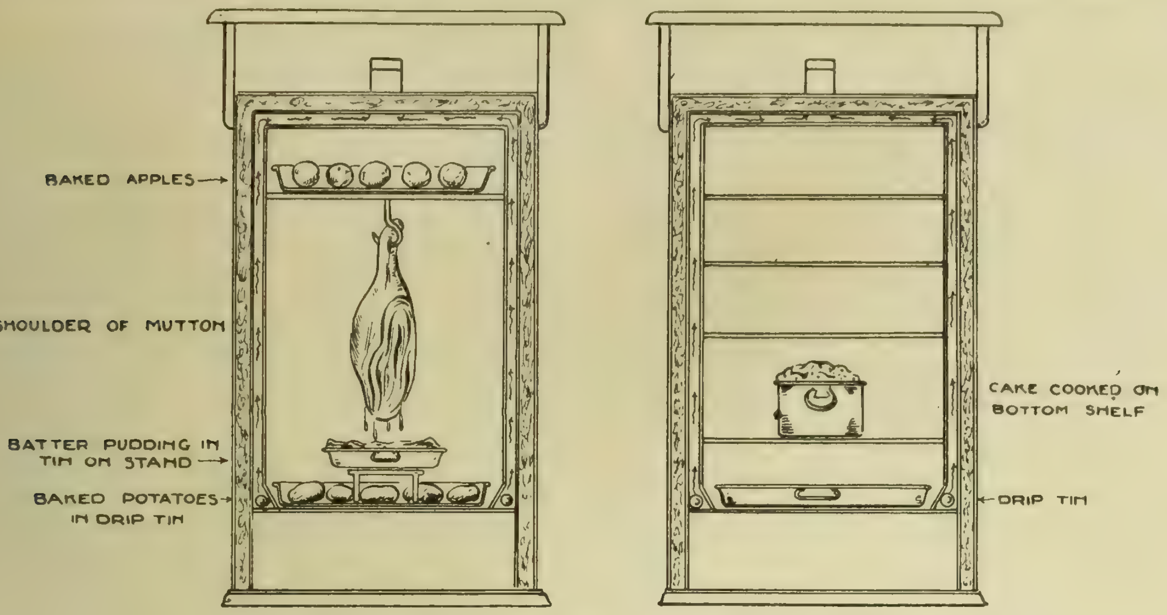
TABLE II.—Externally heated oven, with one gas-burner under bottom, and sheet-iron flue casing at sides and top.

TABLE III.—Externally heated Potterton "Sealed" oven, with two burners, one on each side at bottom, with cast-iron flue casing at sides and partly on top. The advantage with this type of oven is that the dripping-pan can stand right down on the bottom.

TABLE I.—*Test of Ordinary Gas-Oven.*

Time.	Gas Consumed. Cub. Ft.	Degrees Fahr. Top of Oven.	Degrees Fahr. Bottom Grid.	Remarks.
7·45	—	—	—	Gas lighted.
8.0	7	475	470	
8 30	13	380	355	One thermometer on top grid and other on bottom grid.
9.0	19	390	360	
9.30	24½	370	345	
10.0	29¾	365	340	
10.30	35	365	340	
11.0	40¼	360	335	
11.30	45¼	358	330	
11.45	47½	358	330	Gas turned off.
TIME: Four hours. GAS CONSUMPTION: 47½ cubic feet.				
12.45	—	125	110	One hour after turning-off gas.

COOKING SPACE IN OVEN: 14 in. by 13 in. by 19 in.


BAKED APPLES
SHOULDER OF MUTTON
BATTER PUDDING IN TIN ON STAND
BAKED POTATOES IN DRIP TIN
CAKE COOKED ON BOTTOM SHELF
DRIP TIN

POTTERTON'S "SEALED" OVEN, HEATED EXTERNALLY.

TABLE II.—*Externally Heated Gas-Stove.*

(Not of the "Sealed" Type.)

Time.		Gas Consumed. Cub. Ft.		Degrees Fahr. Top of Oven.		Degrees Fahr. Bottom of Oven.		Pressure.	Remarks.
11.30	..	—	..	—	..	—	..	35/10	One thermometer on top grid, other on bottom grid.
12.0	..	12·9	..	370	..	420	..		Gas reduced.
12.30	..	19·2	..	380	..	410	..		
1.0	..	23·9	..	340	..	380	..		
1.30	..	29·5	..	320	..	350	..		
2.0	..	35·6	..	340	..	370	..		
2.30	..	40	..	350	..	390	..		
3.0	..	45·9	..	350	..	390	..		
3.30	..	50	..	350	..	390	..		Gas turned off.

TIME : Four hours. GAS CONSUMPTION : ·50 cubic feet.

4 30	..	—	..	190	..	190	..		One hour after turning off gas.

INSIDE DIMENSIONS OF OVEN : 17 in. by 14 in. by 13 in.

TABLE III.—*Test of No. 1 Externally Heated "Sealed" Oven.*

Time.		Gas Consumed. Cub. Ft.		Degrees Fahr. Top of Oven.		Degrees Fahr. Drip-Tin.	Remarks.
10.30	..	—	..	—	..	—	Gas lighted.
11.0	..	13	..	405	..	455	One thermometer on top grid shelf, the other in drip-tin.
11.5	..	15	..	440	..	500	Gas reduced.
11.30	..	17½	..	442	..	415	
12.0	..	20	..	400	..	355	
12.30	..	22¾	..	370	..	328	
1.0	..	25¾	..	360	..	325	
1.30	..	28¾	..	365	..	330	
2.0	..	31¾	..	355	..	320	
2.30	..	34¾	..	350	..	320	Gas turned off.

TIME : Four hours. GAS CONSUMPTION : 34¾ cubic feet.

3.30	..	—	..	230	..	190	One hour after turning-off gas.

INSIDE DIMENSIONS OF OVEN : 14¾ in. by 13 in. by 20 in.

The two tables which it is useful to compare are the first and the third—being tests respectively with an ordinary cooker and an externally heated "Sealed" oven. The rise in temperatures will be noted; and for attaining and maintaining approximately even temperatures, it will be observed that 47½ cubic feet of gas were consumed in the ordinary oven, as against 34¾ cubic feet in the "Sealed" oven—a saving of 12¾ cubic feet for a single run. Another point to remark is that an hour after turning-off the gas the temperature at the top of the ordinary oven was 125° Fahr., and at the top of the "Sealed" oven 230° Fahr.; while at the bottom grid with the former, it was 110° Fahr., and at the drip-tin of the latter 190°. This residual heat is of value, and can be put to good use in the cooking operations. The change from sheet-iron to cast-iron flue casings in the case of the "Sealed" oven necessitates rather more time to heat-up; but the heat is retained longer after the gas is turned-off. This is proof that there is less loss of heat by radiation throughout the time of use—hence one reason for the smaller consumption of gas; the other reason being that the heat generated by the combustion of the gas is put to more effective use, through the oven being encased by it. In making these temperature tests, Mr. Potterton's view is that the proper method of ascertaining the relative costs of cooking in an oven is to find the cost of maintaining a cooking temperature for three or four hours.

Further as to the oven temperature in Tables I., II., and III., it should be observed that in each case it was raised to 400° Fahr. and upwards, and then set to burn sufficient gas to keep the oven up to 350° Fahr.—a low cooking temperature; the ordinary oven No. 1 and the externally heated oven No. 2 each consuming 10 cubic feet of gas per hour. The advantage was with the externally heated oven. With the Potterton "Sealed" oven, only 5 cubic feet per hour were consumed. A series of tests shows that, after heating up a "Sealed" oven, the consumption of 8 cubic feet of gas will do the same work as 14 cubic feet in an ordinary oven. The results of these tests are as follows:

Ordinary Cooker.

Gas lighted 5.45.

Gas Consumption.		Oven Temps. Top.	Bottom.
4 cub. ft.	. . .	400°	265°
8 ,, ,,	. . .	440°	340°
12 ,, ,,	. . .	460°	340°

Gas reduced to 14½ cub. ft. per hour.

One hour later at 14½ cub. ft. per hour.

Total gas:

26½ cub. ft.	. .	450°	350°

Cooking space:
19 in. by 14½ in. by 12 in.

Externally Heated "Sealed" Cooker.

Gas lighted 5 55.

Gas Consumption.		Oven Temps. Top.	Bottom.
4 cub. ft.	. . .	168°	150°
8 ,, ,,	. . .	300°	320°
12 ,, ,,	. . .	410°	444°

Gas reduced to 8½ cub. ft. per hour.

One hour later at 8½ cub. ft. per hour.

Total gas:

20½ cub. ft.	. .	440°	410°

Cooking space:
20 in. by 13¾ in. by 13 in.

We may conclude this presentment of interesting data concerning the temperatures and gas consumptions of ordinary and externally heated ovens by giving the results of an actual test made, by a lady cook of one of the London gas companies, at a private house at Wandsworth Common.

Test of Potterton's Patent No. 3 "Sealed" Oven Cooker.

Gas lighted	10.0 a.m.
Four pastries put into oven, under browning-shelf	10.30
Four pastries taken out	10.40
Two pastries put in—one on first shelf, one in drip-tin	10 40
Two pastries taken out	10.50
Four pastries put in	10.50
Four pastries taken out (browning-shelf out). .	10.58
Apple tart put in	11.0
Pastry brown (gas turned half-down)	11.15
Gas out	11.17
Pastry taken out (too brown)	11.25
Meat put in, and gas re-lighted . . . . [Turned half-down.]	11.30
Meat hung from grid shelf.	
Potatoes put in drip-tin.	
On top shelf, milk pudding and jam tart.	
Batter put in, and gas turned on a little . . .	12.15 p.m.
Tart taken out.	
Meat, potatoes, and batter taken out	1.0

Shoulder of mutton (5 lbs. 7 oz.), batter pudding, and potatoes, and rice pudding, well cooked.

Mr. John Webster, M.Inst.C.E., the Bradford Deputy Water Engineer, and his wife celebrated their Golden Wedding anniversary on the 5th inst.; and, as it happened, the event almost synchronized with the completion of fifty years' service in the department. Mr. Webster (who is 73 years of age) justly claims that he has grown up with the Bradford water undertaking. He has served the department under three Chief Engineers—Mr. Charles Gott, Sir Alexander Binnie, and Mr. James Watson, the present Engineer.

WATER BILLS FOR THE COMING SESSION.

Among the projects that will engage the attention of Parliament during the ensuing session—beyond the Gas Bills, &c., that have already been dealt with in our columns, *ante*, pp. 15, 75, 133—are the following

WATER BILLS.

The Corporation of Burnley are asking for an extension of time for the construction of certain water-works authorized by their Act of 1908. Included in this authorization was the Hurstwood reservoir, with the construction of which considerable progress has been made. But it may not be possible to complete it within the time limited by the Act, which expires on Aug. 1, 1918. Hence the application for an extension of time. Owing to unforeseen engineering difficulties, the estimate of expense for the construction of the reservoir and other works connected therewith has been found to be insufficient; and the money which the Corporation were empowered to raise for the purchase of lands and wayleaves, and for the construction of the water-works, has been exhausted. So they desire power to raise further money. The extension of time sought is five years from Aug. 1, 1918; and the additional borrowing powers for the construction and completion of the Hurstwood and other works are £160,000, repayable in sixty years. New proposals are made as to rents for the supply of water for domestic purposes. It is intended that the rent shall be a sum not exceeding 8 per cent. per annum on the gross estimated rental of the premises—provided that the Corporation at the commencement of every financial year or half year, as they may determine, shall make an estimate of the probable revenue and expenditure which will be received and incurred during the year or half year as the case may be; and if such estimate, without taking into account any sum paid to the reserve fund, shows that there will be a deficiency in the net revenue of the water undertaking for the year or half year as the case may be, the Corporation may charge a rent not exceeding 10 per cent. on such gross estimated rental; provided further that the Corporation shall not in any case be compelled to charge for water supplied for domestic purposes to any premises or part of any premises any less rent than 2d. per week. The Treasury limitation as to raising money is included in the Bill. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

Additional water-works are required by Tynemouth; and the necessary powers are being sought. The Corporation have water-works on, and obtain a supply of water from, the River Font and the Fallowlees Burn; the water being supplied within the borough and the urban district of Whitley and Monkseaton, and to certain local authorities, companies, and persons outside these limits. The Ashington District Council were in Parliament last session seeking powers to obtain water from sources which the Tynemouth Corporation contended should be reserved for the augmentation of their supplies, and some of which sources were actually situate upon lands already acquired by the Corporation. A Committee of the House of Commons found that an adequate supply of water was urgently needed in the Ashington district; but they thought that economy in expenditure, and the utilization to the best advantage of the available water resources of the neighbourhood, would result from Tynemouth promoting a Bill to supply water throughout the Ashington district, and to purchase the mains, pipes, and meters in the district. Complying with this furnishes one of the principal features of the Bill now in Parliament. The clauses provide for the supply of the Ashington district from the Hebron service reservoir (which will have a capacity of 1,100,000 gallons), as soon as its construction is completed. Then provision is made for the sale to the Corporation of the mains, pipes, and meters of the District Council. Agreements with the Duke of Portland and the Ashington Coal Company, Limited, are to be cancelled; and, until Dec. 29, 1931, the Corporation are to be entitled to the exclusive use of certain plant and apparatus of the Coal Company at an annual rent of £150. But power of subsequent purchase is given. The works to be authorized are: No. 1, a line of pipes terminating in the Hebron service reservoir; No. 2, the service reservoir; No. 3, a line of pipes from the reservoir to Ashington; and Nos. 5 to 10, are aqueducts, conduits, or lines of pipes. Powers to purchase lands and to take waters are included. If the Corporation within a period of three years, or such other period as the Local Government Board may allow, are not furnishing, or are not prepared to furnish on demand, a sufficient supply of water, the powers to supply within the district are thereupon to cease and determine. Periods are named within which the various works have to be completed. There are provisions for the benefit of the fisheries in Coquet fishery district. The North British Railway, the Duke of Portland, the Hon. Hugh Edward Joicey, the Duke of Northumberland, Isabella Francis Thorp and others, and the Rothbury Water Company have protecting clauses. Should the Morpeth Rural District Council require for the supply of East Chevington a supply of water in bulk, not exceeding a maximum of 40,000 gallons per day, it is to be supplied at the price of 6d. per 1000 gallons—the water to be taken from the new Hebron service reservoir. The complete financial requirements are: For the purchase of lands and easements for the construction of works Nos. 1, 2, and 3, £27,860, with a repayment period of sixty years from the date or dates of borrowing. For the purchase of the water mains and meters belonging to the Council, the sum requisite, with a repayment period of thirty years. For any capital or compounded sum or sums of money payable by the Corporation in connection with the repeal of the agreements of the Ashington Coal Company, and uses of their plant and apparatus, the sum requisite, repayable within such period as the Local Government Board may sanction. For expenditure already incurred in connection with lands, £3200, with a repayment period of sixty years. For the purchase of further lands and easements for the construction of works Nos. 5 to 10, £49,400, with repayment in sixty years. For provision of benefit for the fisheries in the Coquet fishery district, the sum requisite, with repayment in sixty years. For the enlargement of works No. 2, £7600, with sixty years repayment. For new mains, extensions of mains, service-pipes, &c., £10,000, with a repayment period of thirty years. Further borrowings will be with the sanction of the Local Government Board. [*Parliamentary Agents: Messrs. Torr, Durnford, and Co.*]

The Wakefield City Council are desirous of not proceeding with the construction of the impounding Oxygrains, Booth Dean, and Linsgreave reservoirs as authorized by the Corporation 1889 Act, and to construct on the sites of the first two named other reservoirs. It is submitted that it is expedient that the time for the construction of the Lee Hill reservoir and the line of pipes authorized by the Act of 1889 should be further extended. By the Acts of 1889 and 1909, the Corporation were authorized to borrow money for the purposes of the works authorized by the Act of 1889; but £9868, sanctioned by the Act of 1889 has not been borrowed, nor has any of the money (amounting to £150,000) authorized by the Act of 1909. In consequence of the abandonment of the Oxygrains, Booth Dean, and the Linsgreave reservoirs, and their substitution by other works, it is submitted that it is expedient that the Corporation should be empowered to apply to the purposes of the present measure the sum of £5000, part of the £9868 authorized by the Act of 1889 and the £150,000 authorized by the Act of 1909. The estimate for the purchase of lands and the construction of works is £155,000. The new works proposed are an enlargement and extension of the Green Withens reservoir, to be formed by lengthening the existing embankment and raising it throughout to a height of 2 ft. 6 in. above the top of the present embankment; a line of pipes or conduit commencing in the Linsgreave Catchwater; an impounding reservoir to be called the New Oxygrains reservoir, to be formed by means of an embankment 6¼ chains or thereabouts in length; a line of pipes or conduit, to be called the Oxygrains conduit; an impounding reservoir to be known as the Upper Booth Dean reservoir; an impounding reservoir to be called the Lower Booth Dean reservoir; and a gauge basin. There are some clauses referring to the accommodation of workmen during the construction of the reservoirs, to the power to take water, and to the provision of compensation in water. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

By their Act of 1889, the Yeadon Water-Works Company were empowered to divert, impound, and use the waters of the Black Beck and the Middle Beck, and all other springs, streams, and waters which would or might be intercepted by works shown on plans then deposited, or which might be found in, on, or under any of the lands for the time being belonging to the Company; but they were prohibited from taking the water flowing from any land eastward of the eastern boundary of Hawksworth Moor. The waters of the Black Beck and Middle Beck constitute the main supply for the Company's statutory limits; and it is of great importance to the Company and their consumers that the waters of the drainage area of the becks above the Company's aqueducts should not be diverted from such drainage area, or be prejudicially affected. With the view to prevent this, and to secure and preserve the quantity and purity of the waters that the Company were, by their Act of 1889, authorized to divert, impound, and use, they have entered into an agreement for the purchase of certain lands and water rights, while preserving the use of the land for sporting purposes. It is declared expedient and urgent that the agreement be confirmed, and that the Company be empowered to carry the same into effect. They also require sanction to the construction of additional works, and to the acquisition of further lands, easements, and rights, and to have repealed the prohibition as to water flowing from any land situate eastward of the boundary before mentioned. They also seek power to supply Hawksworth (through which their mains pass), and to be relieved of an obligation to supply water to Baildon if so required by the local authority—the obligation having been in existence since 1889, but the Company have never been called upon for a supply. The capital the Company are authorized to issue, under their Acts of 1870 and 1889, totals to £49,991; but they have raised £50,288, including £2296 of premiums. The loan capital authorized amounts to £12,500; and £9260 has been raised. The whole of the money has been properly applied to capital purposes, as well as a further sum of £3300. The Company now ask that the stock raised under the Act of 1889 which has produced (with premiums) an amount exceeding the £28,000 authorized, be confirmed, and that they be empowered to raise additional capital. Turning to the clauses, the works the Company desire authority to carry out are, in the parish of Hawksworth, an enlargement of the Reva reservoir, the construction of three catchwaters, a well, pumping-station, and a rising-main; and, in the urban district of Rawdon, a service-tank and two conduits. Ten years are proposed as the period within which the works are to be completed. The proposed powers in regard to the taking of water and the acquisition of land are defined; and it is suggested that the compensation water provided for by the Act of 1889 shall be accepted by all persons interested as full compensation for any waters taken under the powers of the present measure. It is contemplated that the limits of supply may be extended so as to include the urban district of Guiseley and the parish of Hawksworth. Power is also desired to purchase the undertaking of the Guiseley Water-Works Company, or part of it. If after the expiration of seven years, the Company are not supplying or not sufficiently supplying Hawksworth, the Rural District Council of Wharfedale may provide a supply; and similar powers (applicable at any time after the acquisition of the property of the Guiseley Company) are to be conferred upon the Guiseley District Council. The additional capital sought is £10,000; such part as is issued as ordinary being entitled to a dividend of 7 per cent., and such part as is issued as preference to 6 per cent. The borrowing powers proposed, under the Acts of 1870 and 1889 (including the £9260 already borrowed), amount to £16,760; and up to one-third part on the additional capital. Power to issue redeemable debenture or preference stock is sought, with the formation of a redemption fund. A number of miscellaneous clauses are inserted in the Bill. [*Parliamentary Agents: Messrs. Rees and Freres.*]

PERFUMES FROM TAR OILS.

In continuation of his series of notes on the highly-refined organic substances in commercial demand for which oils from gas tar supply the raw material [see "Journal," Vol. CXXXII., pp. 597, 707] Professor A. Mailhe, of Toulouse, deals, in a recent issue of the "Journal des Usines à Gaz," with those employed in perfumery. Here, as he points out, progress in replacing natural products by those of the chemical factory has not been so rapid as in the far greater field of colouring matters. Nevertheless, his prediction is that synthetic methods will revolutionize the perfumes industry as it has already done that of dyes. Much has already been accomplished. One notable instance is vanillin, one of the most widely-used perfumes and prepared, in many factories, identical in composition with that extracted from vanilla pods. The manufacture of vanillin is covered by over seventy patents; while the price per kilo has fallen from 8750 frs. in 1876 to 50 frs. in 1913.

Other perfumes, which likewise are the subject of industrial manufacture, are heliotropine, essence of bitter almonds, and artificial aubepine, all of which are bodies identical in chemical composition with the same perfumes obtained from plants. In a different category, however, is artificial essence of violet—a synthetic perfume which chemically has nothing in common with the essence extracted from violets. This body opens up new fields in synthetic chemistry—viz., the creation of artificial perfumes similar in odour to those of certain plants, but not identical with the latter in chemical composition. On these lines much work has been done and important results obtained, often by chance. The most notable of these is artificial musk, which chemically is in no way analogous to the principal odoriferant in natural musk. The latter has been almost completely supplanted by the former, which at the present time is the basis of most commercial perfumes. Another important series of artificial perfumes is the geraniums, made at prices from 8 to 10 frs. per kilo.

As raw material for the manufacture of perfumes, light tar oils are of importance from their content of benzene, which is readily converted into nitro-benzene, yielding essence of mirbane with its odour of bitter almonds. Toluene is likewise readily convertible into benzoic aldehyde or essence of bitter almonds, identical with the natural product present in peach kernels, cherries, and leaves of the cherry laurel. It is further converted into cinnamic aldehyde, the chief constituent of Chinese or Ceylon essence of cinnamon. It has the strong odour of cinnamon, and by reduction yields cinnamic alcohol or artificial hyacinth.

The cumenes and xylenes in light oils also form the raw stuff of the perfume maker. Paracumene is identical with that in essence of thyme; while metaxylene is converted into artificial musk. Toluene yields a valuable artificial perfume allied to musk.

From the medium oils, phenol is the material used in making artificial geranium (phenyl oxide) by a direct catalytic process. The three cresols, by the same process, yield cresol oxides, also of the geranium odour. By employing mixtures of phenols and cresols, various artificial geraniums are producible, though hitherto only with great difficulty. The process is one which makers have attempted to place on a factory basis.

Also *B*-naphthol, with methyl or ethyl alcohol, yields, by a catalytic process, the perfumes yara-yara and neroline respectively, which form the base of eau-de-cologne.

Again, salicylic aldehyde, from phenol by the action of chloroform and potash, forms an important perfume, while methyl salicylate is essence of winter green, and salicylic aldehyde, by action of acetic anhydride, gives rise to coumarine, remarkable for its soft perfume.

These various examples, M. Mailhe concludes, demonstrate the importance of coal distillates for manufacturing perfumes. The less rapid progress in the synthetic production of perfumes arises from the difficulty of isolating and identifying the many different bodies in essences. With further knowledge of these constituents, great progress will undoubtedly be made in the factory production of perfumes.

YORKSHIRE JUNIOR GAS ASSOCIATION.

The members of the Yorkshire Junior Gas Association met last Saturday afternoon, in the beautifully equipped show-rooms, in Darley Street, of the Bradford Corporation Gas Department. Mr. J. B. Balmforth (the Senior Vice-President) presided, and the recently-elected President (Mr. John Demaine, of the Garforth Gas Company) delivered his Presidential Address.

The Chairman said he was sorry to notice the attendance was rather smaller than usual; but it was easy to understand this in such a time as the present. He might mention that Mr. Charles Roper, of the Bradford gas undertaking, had brought an invitation from Mr. E. Gillett, the Manager of the Thornton Road Gas-Works, to the members to visit the works after the meeting, and view a gasholder which is in course of dismantling.

Mr. John Demaine then gave the following

PRESIDENTIAL ADDRESS.

Unlike many Past-Presidents of this Association and others, it is my first appearance in any presidential capacity; and this, combined with the fact that my sphere of action is confined to the dual capacity of manager and secretary of a comparatively small undertaking, may make any remarks of mine seem commonplace when compared with the highly technical addresses which have from time to time been given.

I wish to confine my remarks to-day to two topics:

Small undertakings and the possibilities that may be attached to them.

The position of small undertakings in respect to the greatly regretted troublesome times, and the uncertain future as affecting the working and financial standpoints.

POSSIBILITIES OF SMALL UNDERTAKINGS.

The possibilities of small undertakings are many and wide in the matter of the attainment of that greatly desired end—increased sales, and (following in due course) increased returns. By increased returns I do not mean being content with the same profit per 1000 cubic feet of gas made, or sold, or per ton of coal carbonized, but an increased ratio; for if this is not aimed at, it could well be argued, Why spend money in developing your undertaking and increasing your indebtedness and responsibilities for no increased pecuniary returns?

One of the first aims of anyone in charge of a gas undertaking is to give the best possible satisfaction to the consumers generally, and to keep in the good graces of the local authority; for if these objects are attained, or even partially so, many rough places can be made smooth, as pleasant business and working relations constitute in themselves a handsome asset. This applies particularly to small companies; and only those in charge of small works can understand how unpleasant things can otherwise be made.

Another great aim is to reduce the standing charges as much as possible; for therein lies one of the greatest assets of any gas undertaking. This can only be attained by an increased output commensurate with judicial capital expenditure. It is, of course, agreed that we must see some certain return for any expenditure before we can recommend our Boards or Committees to commit themselves to it. Any capital expended otherwise lies dead, and weighs most heavily—far more so than in very large undertakings, and therein, perhaps, lies the reason why so many small undertakings do not launch out into new ventures, which, if well carried out, would certainly result in highly beneficial returns—it being always kept in mind that every additional 1000 cubic feet of gas sold should yield an increased ratio of profit by automatically reducing the manufacturing charges, and so eventually the selling price.

HIGH-PRESSURE DISTRIBUTION AND SLOT METERS.

In these days of high-pressure distribution, extensions into outlying districts, which would never have been seriously thought of have become possible, and can be carried out at a capital expenditure which would not have been thought feasible only a few years ago. In such districts lie many fruitful fields, which are only waiting to be developed, and which turn out capital investments; for, be it remembered, "Once there, always there."

In our own particular district—a mixed one, comprising a residential and mining population—we were at a standstill, more or less, up to a few years ago, when it was decided to try slot installations on a limited scale. This was commenced in the latter part of 1906; and a marked improvement in the output immediately resulted. The policy was continued, and the output was steadily increased, as the following particulars show:

Year.	Number of Consumers.	Sale of Gas.
1905	233	4,529,000 cubic feet
1906	400	4,782,000 ,,
1909	654	6,627,000 ,,
1912	803	9,765,000 ,,
1915	1300	15,000,000 ,,

The earlier increases were practically wholly due to the introduction of slot installations; while, as will be seen later, the latter increases resulted from additional consumers secured through extensions to outlying districts.

In the early part of the above period, and very possibly as a result of the go-ahead policy being adopted, public lighting was established; so that now we have a total of 153 lamps, which, as the number has steadily grown, has proved a valuable asset.

GRADUAL EXTENSIONS OF PLANT.

Of course, it will be perfectly understood that these greatly increased sales demanded a large increase, or seemingly large increase, in the capital outlay to provide for extensions of works, new mains, &c. Unfortunately, the original design of the works did not allow much for any possible increase in the output; and up to a certain point only the existing works, with minor alterations, kept pace with the extra demand. The time came, however, when something had to be done. The site being a valuable one, a removal of the works was not to be entertained; so it was decided to extend in a gradual manner, which was done in something of the following order.

An exhauster was installed, with a gas-engine, boiler, and steam-engine (as a stand-by), new workshop and store, new purifiers, new station meter and governor, new gasholder in a steel tank, compressor, retort-house extended, and direct-fired setting replaced by regenerators. Saving the site, therefore, we have very little left of the works and apparatus which were in use seven or eight years ago; but in its place we have plant for dealing with (by very little additional expense) a make of 25 to 30 millions.

Eight years ago, there was no exhauster in use, and, indeed, very good results were being obtained without one—results perhaps as good as are being obtained in some small works to-day with an exhauster in use. Again, up to two years ago, we had only direct-fired settings at work, and very good results we got from them, too, as we regularly sold 7½ to 8 cwt. of coke per ton of coal carbonized, and made 11,000 to 11,200 cubic feet of gas per ton. This condition of things caused the Directors to be very loth to make any change in the matter of retort-settings, which was perhaps natural. However, the change was eventually made; and we are now reaping immense benefit from it, by an increased sale of at least 2½ cwt. of coke per ton of coal—and an extra 2½ cwt. on a matter of 1400 tons of coal pays a very handsome return on the outlay incurred.

GAS OR STEAM FOR DRIVING.

Here, I might with advantage, I think, touch on the question of the "Drive" employed on small works—say, from 20 to 25 millions. On quite a number of works which I have visited in the course of travelling about the country on holidays, &c., I have noticed that a boiler and steam-engine are employed for the purposes of driving an exhauster, washer, pumps, &c.

On one works in particular—a works making about 11 millions—(quite remote from Yorkshire by the way), I noticed a large steam-engine of old-fashioned design, and of about 7 to 8 H.P. pounding away at about 3 H.P.; the engine itself being in a bad state of repair. The cost of driving must have been enormous.

What amazed me most, however, was that they were selling coke at £1 per ton; and I have often wondered if the management had ever thought of what saving could be effected by installing a gas-engine. At a rough estimate I should say about £70 per annum easily. In my opinion, a gas-engine drive is ideal for gas-works plant, and should be installed wherever practicable, as the saving in coke, labour, and wear and tear is not to be despised in these times, or indeed at any time.

THE DISTRIBUTION SYSTEM.

Turning now for a short time to the necessary extensions in our distribution system. In 1909 we had just 4 miles of mains—the largest being 6-inch. We have now 15¼ miles, varying in size to 8 inches, included in which figure is 5 miles of 4-inch high-pressure steel main. It will be seen therefore that no small amount of the capital expended (as per the particulars to follow) has been absorbed in the district mains. Excepting the high-pressure main, practically the whole of the mains are of cast-iron.

A few particulars of the high-pressure main may be of interest. We used 4-inch rigid jointed mains of 8/9 gauge, and lead wool for the joints. To the first outlying district, we had Mannesmann tubes, and employed a main jointer from the Lead Wool Company. To the second district we laid Stewarts and Lloyds tubes, of similar size and gauge, doing the jointing ourselves. In regard to the tubes themselves, we had an analysis made of samples, which showed that in strength and quality there was nothing to choose between them—they were excellent pipes throughout, well wrapped and re-coated. A test of 28 lbs. per square inch was made on the first section, and all proved tight. On the second section we made no test (scarcely being in a position to do so); but I was perfectly satisfied that all was tight, and the fact that our leakage per mile of main continues to decrease proves that we had nothing to fear. The trench digging was done by contract, at a price per running yard.

I might here remark that the first out-district mentioned was the village of Aberford, which possessed its own gas-works and one mile of main—the undertaking, with the exception of the site and apparatus, being purchased from the existing Company. The second district was the village of Barwick-in-Elmet, where there was no gas lighting up to the time of our going there. The majority of houses have slot installations; our own men doing the whole of the fitting-up, on piece work—the Company finding all materials.

We compress at the works to ½ lb. pressure per square inch; and at the entrance of each village we have an underground brick chamber, containing duplicate sets of governors, which reduce the pressure down to 3½ inches. These governors are of the diaphragm type, and are capable of dealing with all pressures up to 5 lbs. The compressor is of the rotary type, and capable of passing 5000 cubic feet per hour up to 5 lbs. pressure.

CAPITAL EXPENDITURE.

Below is given the capital expended per million cubic feet sold over the period 1906 to 1915.

Year.	Capital.	Gas Sold. Cubic Feet.	Expended per Million Feet Sold.
1906	£6,588	4,782,000	£1370
1907	7,000	5,662,000	1236
1911	9,000	9,402,000	957
1915	14,467	15,100,000	958

Increase in capital expended . . . . . . 106 per cent.
Increase in gas sold . . . . 166 ,,

It will thus be seen that there is a marked fall in the capital expended per million; and this in spite of the fact that we have had to provide pipes and fittings for something like 700 consumers, while at the best of times it is an expensive matter remodelling old works. Moreover, we have works which have now practically new plant throughout, the capacity of which can be largely increased from present requirements, at very little cost—a works which is of infinitely more value and of better earning capacity than some years ago.

THE WAR AND THE INDUSTRY.

Treating now with the second part of my subject—the effect of the times on the position of small undertakings. The war has made its effect on the whole of the industry of the country in different ways. Gas-works have answered the call for men to a remarkable degree, and have given of their best; and, on looking round, it is remarkable how work is being carried on at the usual high standard, in spite of the number of men who have been lost to them. It is now pretty well known to the country in general the great part which gas-works are taking in supplying raw materials for the production of high explosives, and the many uses to which gas is being put in munition factories and others. Its uses are almost legion; and the public generally, would be greatly surprised if they knew one-half of the many purposes in which its use has been found of value. No doubts exist in my own mind that when the war does come to a close, gas will have found a permanent home in many places for numerous purposes for which it has not hitherto been used; and therefore all means in our power should be exerted to make the best of these opportunities.

LABOUR SCARCITY.

The past year, as you are aware, has been notable for many things as affecting gas-works, among which are the great difficulty that has been experienced in obtaining suitable labour to carry on work, in obtaining anything like full quantities of coal and other materials, and in getting rid of bye-products, owing to railway congestion and other causes beyond our control.

Our friends in large works have undoubtedly felt the pinch of labour. It must, however, be remembered that they have generally abundant machinery; and if they are short of a man or two, they might not be seriously inconvenienced. But on small works, where possibly only one or two men are kept per shift, if they fail, matters are at once serious. No doubt some of us could tell of having to tackle work in many directions which previously we should not have thought of touching. However, "necessity knows no law;" and when the tale comes to be told, it will prove highly interesting.

In regard to labour, in my own case we have seven coal mines within a radius of three miles, all shorthanded; and owing to the high prices they are receiving for coal, they are in a position to pay (and do pay) such wages to any man they can get as appears fabulous—8s. to 10s. per eight hours day and free, or exceedingly cheap, coal found. Then, in addition, we have a huge shell-filling factory in course of construction not more than a mile away, where labourers are being paid 8d. to 8½d. per hour—men earning over £3 per week for labouring. How are works like ours to carry on in face of things like these?—simply the best way we can.

I am, along with others, looking forward to the time when some thoughtful person will bring along a simple charging and discharging machine, or some system of modified vertical retorts, perhaps, which can be installed in small works. I believe such a system would be welcomed with open arms.

As to the financial aspect, this part of the subject I do not intend to dwell upon to any great extent. Consequent on the vast increase in the price of coal and other materials and labour, it is almost exceptional to find any gas-works which have been able to continue to sell gas at pre-war rates. Some have had to increase more than others—possibly on account of the great distance from the coalfields (more especially where the coal is sea-borne). But possibly, on closer examination, it may be found that other influences have had some effect on the amount of increase determined upon. Among such causes may be found—

(1) Capital account, which is not proportionate to the size of the undertaking.
(2) Where the responsible heads have not been sufficiently up to date in introducing improved methods of carbonization and working generally.

THE CAPITAL ACCOUNT AND UP-TO-DATE METHODS.

The first cause is rather a complicated question to tackle; but, whatever the reason, the effect is there, and it is undoubtedly a severe handicap on an undertaking at the present time, and when competition is to be met its effects are very far-reaching. It behoves us, therefore, to watch very closely at all times any large expenditure being placed to capital account which might with every justification be placed against revenue charges, or if necessary to a suspense account, and written-off in so many years.

In reference to being up to date, this may be taken as effecting larger works more in particular. But it does still apply to smaller works, though perhaps in a lesser degree; for, if we cannot undertake to instal (say) stoking machinery and all its adjuncts, to reduce working costs, we might on looking round introduce other minor improvements, which may total up to a comparatively large sum. Take, for instance, the replacement of steam by a gas-engine, and the large saving effected thereby; the better washing of the gas for the extraction of ammonia, which in some places is not half done; also better attention paid to leakage, which is a matter sometimes lost sight of. Many other ways and means can be adopted, if they are only looked for and not waited for, by which saving can be effected, and thereby the stability of the concern greatly improved.

In conclusion, I should say that those who had already been alive to the introduction of up-to-date appliances must feel highly pleased in having carried out such schemes; for, undoubtedly, those who still have this expense to face will have to pay very dearly for it for some years to come.

The Chairman, inviting discussion, said the address had been a good one, and the subject had been particularly appropriate to the needs of a great proportion of members. He was one of the members who, like the President, were limited to small works, and it was of great value that they should relate their experiences as managers of small works. One point he would like to ask was with regard to the power for driving the exhausters, pumps, &c. The President said he thought a gas-engine was far cheaper and better than employing coke. He would like to know what he did with his coke breeze. In most works he had found coke breeze in use for this purpose, and he did not think there was anything cheaper than this, especially in winter time.

The Hon. Secretary (Mr. Edward Garsed) said that Mr. Demaine opened by touching on the importance of entering into the good graces of the consumer and of the local authorities. He thought it was almost impossible in small undertakings to wholly attain this object; but there was no doubt that when it was done many rough places were smoothed over. A great deal depended not only on the manager of the works but on the staff, and their tact and discretion in carrying out their own part of the undertaking. It was much easier for managers to keep in the good graces of the authorities if the various heads of departments and others of the staff did their work with a mind always on the well-being of the concern. In regard to the outlay on standing costs, at his own place at Kippax they had had to contend with a lot of trouble arising from the cheap-Jack, door-to-door kind of gas-fittings in use by the consumers; and eventually they decided to attempt to combat this by opening a small shop and show-room of their own. This had proved a standing advertisement by the fact of having maintained a brilliant display and showing the valuable—particularly as compared with the cheap stuff to which the people had been accustomed—apparatus which the Company could supply. It certainly had done away with a lot of argument which was proved to be fictitious when looked into; and it had done a great deal to reduce the standing costs of the undertaking. Where complaints used to come in at the rate of 14 to 20 per day on the round of collecting slot meters, the figure was now something like the same on the whole round, owing to the wiping-out gradually of the cheap fittings. For twelve months prior to opening the shop, the cash sales for fittings had been about £10 to £15. In the first twelve months of its existence there was brought in from sales of fittings about £40; and this in spite of the fact that mantles and other fittings were sold in various kinds of shops in the town. In regard to the driving of gas-engines, his own works had been set out with a vertical three water-tube boiler, which was nothing more nor less than a coke eater. Apart from this, the steam-pump driving was direct, with the result that he was never certain during the night whether the liquor pump had been circulating. Six nights out of seven it did not run properly, and they lost ammonia. They had now a gas-engine; and, specially in view of the present price of coal, it had not far off paid for itself. With regard to coke breeze, his plan had been supposed to use coke breeze; but there was as much coke as coke breeze, and probably more, used in the boiler. Moreover, on many occasions he found that when the fire had been allowed to get low a very appreciable percentage of coal was being used. In regard to capital expenditure, the President had pointed out that a judicious outlay was about the only thing in small undertakings where originally there was a shortage of capital. It seemed a bit strange that, in order to make the most of capital outlay, more should be spent; but it was quite true that the only way to improve matters was to spend more. In the case of his own works, the capital per million cubic feet sold in June, 1911, was £1576. In three years this was reduced by £413 per million. The gas sales had increased by nearly 48 per cent., and the capital expenditure was reduced per million sold by more than 20 per cent. A point which Mr. Demaine had not referred to was the letting out on hire of gas stoves and fires. In the President's case, as in his own, it was difficult in a colliery district, where the mining population were given very cheap loads of coal per month, to think of pushing the use of gas fires and stoves. As to the difficulties of the time on small works, he did not think the war had had any great effect on his undertaking—indeed, they had a good deal more difficulty before the war than they had had since its outbreak. In the matter of housing, houses were so very scarce that they could not be got; and the result had been that his Company had difficulty in keeping stokers. They had had to build one or two houses to keep their men; and this was probably why they were not now troubled by the men going away to the coal mines to earn higher wages. They had, fortunately, built just when prices were beginning to rise—just before the war; and they had a return on the expenditure of about 6 per cent. Another matter which affected them all in small works, where they had no sidings or large coal-stores, was the question of carting coal to the works. They usually kept a moderate stock; but just now they were very much reduced. The question was as to whether they should not have their own team labour; and his undertaking would be glad of any information in regard to the cost of horse-keeping at present. He had intended to suggest, when speaking of housing, that it occurred to him that many larger undertakings might with advantage take this step in preference to co-partnership schemes.

The President said, in reference to Mr. Balmforth's query about power for driving, he quite agreed that steam was very useful on gas-works, particularly in winter. This was why, in his own case, they kept a boiler to look at in summer and to use in winter; but it was also why they had preferred to use a small amount of capital to employ all the year round by the use of a gas-engine. As to fuel used, he was inclined to agree with Mr. Garsed that coke was handier than coke breeze, and that coal, unfortunately, was handier still; and there was a great percentage used. He quite believed that, by the use of a gas-engine, a saving could be effected of about 2½ per cent. of coal carbonized. He agreed that their relations with local authorities were largely in the hands of the staff. One of the principal ideas, of course, in his address was in regard to the opening of roads. Some local authorities were very peculiar about this, and others gave the gas undertaking every chance to do pretty much what it liked. Speaking generally, however, if they did not restore the roads in proper repair, they made trouble quickly. In regard to gas fires and stoves, his undertaking was doing very well with them at present, despite the fact that they were in a colliery district. They did not let out on hire, but sold outright. The fires were an advertisement in themselves, and quite a lot had been sold through the impression people had got by seeing them in use in friends' houses.

Vote of Thanks.

Mr. Charles Roper (Bradford), in moving a vote of thanks to the President for his address, said the question of small works was one which applied, perhaps, to not all the members of the Association; but there was no doubt that throughout the country the smaller works predominated. Any who were going to move away usually went to a small works, and it was as well that even those at present on large works should know something about the small ones. Mr. Demaine had mentioned a point as to the mechanical feeding for retorts. He was afraid the biggest stumbling block was the capital cost, because of the very great amount of time that any such plant would be standing idle. In regard to local authorities, in a large place like Bradford the gas undertaking did not experience much of the trouble which was so common in small places. It was, however, essential for anybody connected with the distributing side of a gas undertaking to leave as little as possible to chance, and that proper notice be given beforehand of the breaking-up of roads, though, of course, they could not give much notice in cases of sudden escapes. With regard to the filling-in of the roads, it was a serious point and one that was not thought as much about as it ought to be. In Bradford, the local authorities compelled all private contractors who broke a road to sign an agreement to make it good. They could imagine what it would be if all gas undertakings had to go through this every time; and this was why they should continue to give road authorities as little trouble as possible. With regard to team labour, he believed one of the largest Lancashire works the Association had visited some time ago had run their own team labour department. Team labour for the gas undertaking was a sorry trouble, and must receive very serious consideration indeed.

Mr. J. M'Lusky (Halifax) seconded the vote, and it was carried unanimously.

On the motion of the Chairman, seconded by Mr. Garsed, a hearty vote of thanks was accorded Mr. Charles Wood, the Gas Engineer to the Bradford Corporation, for the granting of the use of the show-rooms for the meeting.

Visit to the Thornton Road Gas-Works.

The party then adjourned to the Thornton Road Gas-Works, where, under the guidance of Mr. Gillett, the Manager, and one or two Bradford members, they viewed the gasholder which is being dismantled, and also had an informal look at the vertical retorts. The holder was the first one at the works, which were opened in 1846. It has been out of use for some years past, and its dismantling enabled the visitors to note several unusual features. Particular interest was evinced in the wooden struts from the bottom of the sides to the cover, the framing of which, also, was largely of wood. There were iron struts radiating along the bottom of the holder from an unusual wire and wood centre support. The holder had a capacity of about 80,000 cubic feet.

THE UTILIZATION OF ENERGY FROM COAL.

By Professor William A. Bone, D.Sc., Ph.D., F.R.S.

At the Royal Institution of Great Britain last Thursday, Dr. William A. Bone, F.R.S., Professor of Chemical Technology at the Imperial College of Science and Technology, delivered the first of a series of three lectures dealing with the above subject. The second lecture will be delivered on Thursday next, and the final one on Feb. 3.

Fuel Economy.

The question of fuel economy and the proper utilization of coal is at the present juncture, as I pointed out in my Presidential Address to the Chemical Section of the British Association in Manchester, of the greatest national importance, not only in regard to the actual prosecution of the war, but also, and even more so, in view of the trying years of economic recuperation and re-adjustment that will follow hard upon its termination, because, of all directions in which national economy can be most healthfully and advantageously exercised, this is perhaps the most obvious and prolific. It is tolerably certain that, with an efficient and systematic public supervision and control of fuel consumptions, we ought to be able, even with existing appliances, to save many millions of pounds of our annual coal bill, and, with improved method and organization, still more millions—a saving which would, in the long run, redeem a considerable amount of the War Loan, which has been much more easily raised than it will be repaid.

The British Association have recently taken up the matter by appointing a strong Committee of representative chemists, engineers, technologists, and public men to consider the whole question from a national standpoint, and to report, through the Association, to the public, and, if need be, also to the Government, upon the chief direction in which large economies can be effected, and the best means by which the community can ensure their realization. Not only does it appear to me that the community ought to be informed from time to time upon such matters by its scientific leaders, but also that it has the right to insist on the proper and most economical utilization of its coal supplies, both in its own present interests and those of future generations, and that, if need be, the Government should be called upon to take such action as will check the most flagrant cases of wastefulness and abuse.

I am aware that such a suggestion will perhaps be objected to in some quarters on the ground that the operation of progressively higher prices of fuel will, in itself, be the surest and most potent compelling force in the direction of fuel economy in manufacturing operations. Undoubtedly there is something to be said for such a view; for, in the long run, it is the cumulative effect of the daily cost-sheet which impels the commercial mind to seek further economies. Also, it must be admitted that some of the foremost manufacturing concerns have already achieved great results in economy of fuel, and may be held up as shining examples of what can be done by the rigid and systematic application of scientific principles to the heat balance-sheet of a large industrial establishment. I am convinced, however, that the problem will never be solved from a national standpoint by the policy of leaving it to the slow operation of isolated and independent investigations. What is needed is a patriotic exchange and pooling of experience —a willingness to co-operate whole-heartedly and effectively, under skilled guidance and advice, for a national benefit; and this cannot be achieved except on the basis of some national organization.

Value of Coal other than as Fuel.

Not only is coal of prime importance as a fuel, but, when suitably handled by the chemist, it yields very valuable bye-products. Thus from the tar and other condensable products of its distillation are obtained the raw materials for the manufacture of synthetic dyes—an industry which, although founded sixty years ago by the discoveries of British chemists, had, through our culpable neglect of chemistry, become so localized in Germany that at the outbreak of the war we were importing almost three-fourths of the £2,000,000 worth of coal-tar dyes required by our textile industries. This is a state of things as discreditable to our attitude as a nation towards the scientific aspects of industry as it is senseless from a business point of view, and which, it is to be hoped, will never be allowed to recur after the war is over. I do not wish it to be inferred from this sentence that I am advocating any sort of fiscal protection for the coal-tar dyes industry. On the contrary, I am convinced that any departure from our policy of free trade would imperil the interests of our great textile and engineering industries, not to speak of our heavy chemical and metallurgical (iron and steel) industries, and, above all, our shipbuilding and maritime supremacy, each and every one of which is of far greater magnitude and importance than any possible or likely development in the manufacture of dye-stuffs.

In addition to being the raw material for synthetic dyes, certain coal distillation products—toluene in particular—form the basis of the new high explosives which are being used in such large quantities, and with such appalling effects, in this great European War. For years before its outbreak, while German chemists had been diligently investigating the possibilities of T.N.T. as a high explosive, German technologists had already paved the way for its military use by ensuring a maximum supply of raw materials from German coal by the substitution throughout Germany of modern bye-product recovery coking plants for the old wasteful beehive ovens, whereas we were still, at the outbreak of the war, carbonizing about 6½ million tons of coal per annum in the beehive ovens—a state of affairs which is deplorable from every point of view, showing as it does how negligent and short-sighted we are of national interests in exploiting the most important of all our raw materials.

Another notable bye-product obtainable from coal is ammonia, in the form usually of sulphate, which is chiefly valuable in agriculture as a fertilizer. Indeed, the world depends upon the nitrogen in coal for about 90 per cent. of its ammonium compounds. Thus, in 1912, of the total British production of 379,000 tons of ammonium salts, no less than 318,000 tons were derived from coal. Here, again, we compare unfavourably with Germany, who in the same year produced nearly 500,000 tons of ammonium salts from a smaller total output of coal. Seeing that the profit on the production of ammonium sulphate was then certainly not less than £10 per ton, the profits accruing to the German people in that year from ammonium sulphate derived from coal probably exceeded ours by something like £2,000,000.

Origin of Coal.

To understand the nature and composition of coal, as well as the different classes and varieties of it met with in our coalfields, we must consider the kind of materials from which it originated, as well as the conditions under which these materials were, in the fulness of geological time, gradually transformed into the coalfields as we now know them. Our knowledge of these matters, of course, necessarily suffers from the recognized imperfections in the geological record, and therefore the scientific imagination has often to fill in gaps where precise information or definition is wanting. Therefore, while we are tolerably certain of the vegetable origin of coal, any view or theory concerning the factors and conditions operative at the various successive stages in the subsequent long transformation process is necessarily somewhat speculative, and subject to reservation. Certain well-attested features which stand out prominently in the record may, however, be regarded as more or less common ground.

Although many classes and varieties of coal occur in Nature, all of them represent some stage or product of the primary decomposition and subsequent transformation under the combined influence of slowly increasing pressure, and possibly also temperature, upon the vegetable *débris* of primæval forests and swamps. This process has gone on in nearly all the great geological epochs, and, so far as its early stages are concerned, is being repeated today, under somewhat different conditions, in our modern peat bogs and deltas, where enormous masses of water-logged vegetable *débris* are decomposing under bacterial influence.

Much controversy has waged round the question of whether or not coal formation has occurred upon the actual site of the original vegetable growth; and in certain cases the question can be answered affirmatively. The necessary conditions in such a case would be a dense forest growth in swampy areas (estuarine, or in great inland swamps) together with such rapid oscillations in level as are known to have occurred during the carboniferous period. The rotting vegetable *débris* would, during a period of subsidence, be overlaid with layers of water, deposited sands, and clays, which on re-elevation provided a suitable soil for renewed vegetable growth. Proof of such conditions is afforded by the occurrence of "under clays," with fossil roots (stigmaria), below the coal seams in certain areas. Some other coalfields, however, undoubtedly owe their origin to enormous masses of vegetable *débris* brought down from higher levels and deposited either in deltas or in land-locked seas or lakes. Such fields show no fossil roots in the under-strata, and in some cases fossil remains or aqueous and marine life are found immediately above and below the coal seams.

Such primæval swamp forests would, with gradual fall in level, become submerged to a greater extent, and be covered with water-borne soil and mineral matter, which, on subsequent re-elevation, would be ready for a fresh vegetable growth. Repetition of the process—*i.e.*, the ultimate gradual submersion and re-elevation—would produce several distinct deposits of decomposed vegetable matter separated by mineral matter of sedimentary origin, which would ultimately give rise to the various separate seams of coal found in our modern coalfields.

Finally, such successive deposits would, in the course of geological time, become buried as a whole under newer mineral strata, whose accumulation would "blanket" the incipient coal measures, causing a gradual increase in both temperature and pressure. Moreover, it is known that, during the later stages of the carboniferous period, the "blanketed" strata were subjected to intense seismic disturbances, the effect of which would be to cause great local increases in temperature and pressure. These causes, operating successively, would sufficiently account for the transformation of the original decaying woody tissue into bituminous coal and anthracite. Such changes as I have described would necessarily involve both great shrinkage in bulk and loss of weight in the original vegetable *débris;* and it has been clearly demonstrated that the existing coalfields represent about 20 to 28 per cent. only of the original weight, and 1-10th only of the bulk, of the original woody tissue from which they were formed.

Chemical Composition of Coals.

Turning, now, to the chemical composition of coals, from our knowledge of their origin and their mode of formation it may be anticipated that they will contain (*a*) various combustible, organic compounds, complex in structure and of high molecular weight, representing degradation products of the cellulose and resinous matters contained in the vegetable *débris* from which they were originally derived, and (*b*) variable amounts of incombustible mineral matter, which remains behind as ashes when the coal is burnt, and represents partly the ashes of the original vegetation, or the soil in which it grew, and partly other associated mineral matter deposited or formed contemporaneously with the coalfield. The amount and composition of such "ash" varies considerably with the locality whence the coal is derived; and not infrequently the seams in a given mine show great variations in the amount and character of their ash content.

It is also necessary to distinguish between heavier mineral matter (dirt)—such as pyrites (specific gravity = 5·0), shales (specific gravity up to 2·5), or gypsum (specific gravity = 2·3)—often mixed with freshly-mined coal (specific gravity = 1·2 to 1·3), from which a separation can be effected by mechanical washing, and the true or fixed ash of the coal, which is disseminated throughout its entire mass, and cannot be so removed.

For purposes of comparison and classification of coal it is necessary to disregard altogether the variable proportions of mineral matter, as well as of mechanically held water, which they may contain, and to fix attention upon the character and composition of the coal substance itself. The following figures for the ultimate compositions of the principal dry ashless raw fuels comprised in the "wood to coal" series indicate that the net result of the transformation of the original vegetable *débris* into the combustible matter of our coalfields has been a progressive concentration in the carbon content and a corresponding diminution in the relative proportion of oxygen in the organic matter—a process which has been marked by a steady increase in the calorific value of the fuel.

Compositions and Calorific Values of Typical Solid Fuels (Dry and Ashless).

—	Carbon. Per Cent.	Hydrogen. Per Cent.	Oxygen or Nitrogen. Per Cent.	Calorific Value. K.C.U.'s per Kilog.
Wood	50·0	6·0	44·0	4000 to 4300
Peat.	50 to 64	4·5 to 6·8	28·6 to 44·0	5000 to 6000
Lignite	60 to 75	5·0	20·0 to 35·0	6000 to 7000
Bituminous coal . .	75 to 90	4·5 to 5·5	5·5 to 15·0	8000 to 9600
Anthracite	90 to 95	2·5	3·0	9200 to 9800

Incidentally, it may here be remarked how little has been accomplished in the way of exploiting the potential fuel value of the world's enormous stores of peat, which, according to some estimates, exceeds that of all the known coalfields. Nor can it be said that, except in Austria and Germany (which in 1913 raised for local consumption 27·4 and 87·1 million tons respectively), have the lignites come into extensive use as coals, owing to the inferior calorific value in the raw state, and their liability to disintegrate when their usually high content of moisture is expelled. The utilization of lignites is, or will be, an important matter for some of our over-seas dominions (notably Australia and Canada); but so far as Great Britain is concerned, the lignite problem may be regarded as non-existent.

The terms "bituminous" or "flaming" coals, of which there are many different varieties, include all the economically important coals except the anthracites. For commercial purposes they are classified according to their suitability for certain specific purposes—such, for instance, as steam raising, gas making, domestic heating, or the manufacture of strong metallurgical coke. The usefulness or otherwise of any given coal for a particular purpose depends principally upon: (1) The amount of volatile matter expelled from it when maintained at a temperature of 900° to 1000° C. out of contact with the air; and (2) the amount and character of the carbonaceous residue or coke (equals fixed carbon *plus* ash) after such volatile matter has been expelled.

Grüner's well-known classification of coals, which is still in my opinion the best for economic purposes, is based upon such data; and I will summarize its principal features.

Class I.—Highly bituminous coals, containing more than 40 per cent. of volatile matter which, on expulsion, leave a non-coherent residue and burn with a very long and highly luminous flame. They are chiefly valued for the firing of reverberatory furnaces and the like, where a long flame is essential, and are used to some extent as house coals. But they are not good for steam raising, and their non-caking character renders them useless for coke manufacture.

Class II.—Containing from 32 to 40 per cent. of "volatile," comprises all the best gas coals. They burn with a long luminous flame, and on distillation pass through a stage of intumescence, during which gas is fully expelled, yielding finally a fairly porous coke of no great strength.

Classes III. and IV.—These comprise all the best coking coals (volatiles, 20 to 32 per cent.), and, as such, are chiefly valued for the manufacture of hard metallurgical coke. They are not, however, suitable for steam raising, because, on burning, they form dense masses of hard coke in the boiler furnace, which can only be completely consumed in a very excessive air supply.

Class V.—This class, sometimes termed semi-bituminous or anthracitic, includes all the finest steam coals, which are usually feebly coking, and burn in a good draught with a short smokeless flame. They are subdivisible into two groups, as follows:

(*a*)	(*b*)
Semi-bituminous steam coals.	Anthracitic hard steam coals.
Volatiles = 14 to 20 per cent.	Volatiles = 8 to 14 per cent.
e.g., the best Welsh "Admiralty" steam coals.	

Anthracites.—Coals containing less than 8 per cent. of volatile matter are classed together as anthracites. In Great Britain they are found for the most part in the west and north-west border of the South Wales coalfield (West Glamorgan, Breconshire, Carmarthenshire, and Pembrokeshire) over an area of 137,000 acres, and to a small extent in certain localities in Scotland (Ayrshire, Linlithgow, and Fife), where the bituminous seams have been subjected to the intrusion of molten igneous material subsequent to the formation of the original coalfield. Nearly 80 per cent. of the world's reserves of anthracite are located in China; and there are extensive fields also in Russia and the United States (Pennsylvania).

Anthracites are usually distinguished by their very low ash content and freedom from sulphur, as compared with bituminous coals; and, owing to their cleanliness and smokeless combustion, they are chiefly used for domestic heating in specially constructed closed stoves, for central heating furnaces, for drying malt, curing rubber, and for other special purposes where a smokeless fuel of great purity is required. The total quantity of anthracite raised in Great Britain in the year 1913 was 5,194,620 tons, of which 4,833,159 tons came from South Wales; and nearly 3 million tons were exported—chiefly to France, Italy, Germany, Sweden, and Holland. The advantage of anthracite for domestic heating is more appreciated upon the Continent (closed slow-combustion stoves are there largely used) than in England, where the open fire-place is the rule.

Until quite recently it has been generally believed that anthracites represent the final stage in the transformation of the original mother-substance of coal, through the intermediate stages represented by lignites and bituminous coals. In support of the view may be cited the fact that anthracites are found in areas which are known to have been subjected to great earth movements or igneous intrusions after the coalfields were laid. But the fact that in the South Wales coalfield, where the character of the seams gradually changes from bituminous to anthracite along a line running roughly south-east to north-west, the ash content diminished as the anthracitization increases is difficult to reconcile with the theory that the anthracite has been formed by the expulsion of volatile matter from the neighbouring bituminous coal; and it has been suggested that in this particular area the anthracite has been formed from a different type of original vegetable *débris*.

It is important to observe that, as a rule, the caking properties of a coal, as well as the strength and density of a coke produced by carbonizing it at a high temperature, vary inversely with the yield of volatiles, until they attain a maximum with 20 to 30 per cent. of volatiles, after which they rapidly diminish. Non-caking coals are principally either: (1) Those of greatest geological age, rich in carbon, with correspondingly low hydrogen and oxygen contents (semi-bituminous, anthracitic or anthracite; (2) those of more recent origin with a high oxygen content; or (3) those from oxidized seams, which at some period subsequent to the formation of the coalfield had become exposed to atmospheric influences—*e.g.*, Warwickshire and Leicestershire seams.

When, however, it comes to the consideration of the real nature of the various chemical compounds contained in coal, I am afraid a lamentable state of ignorance must be confessed. Perhaps the most suggestive of recent chemical researches upon coal are those which Dr. R. V. Wheeler and his co-workers have carried out at the Home Office Experimental Station at Eskmeals, in Cumberland, as part of the larger inquiry on coal-dust explosions in mines. They have closely studied the character of the gaseous products yielded by the decomposition of anthracitic, semi-bituminous, and bituminous coals at definite temperatures between 450° and 1100° C., and have established: (1) That at low temperatures (up to 500°) the gaseous products are chiefly methane and the higher paraffin hydrocarbons, while hydrogen is evolved in comparatively small quantities; (2) that the evolution of paraffins entirely ceases at about 700° C. (the absolute amount of methane reaching a maximum at 900°); and (3) that between 700° and 800° there is a critical point above which evolution of the hydrogen abruptly and rapidly increases.

Such results suggest the existence of at least two distinct types of organic compounds in coals—namely, (1) compounds of low stability, which readily decompose at temperatures between 400° and 700°, yielding, primarily, paraffin hydrocarbons and methane, but comparatively little hydrogen; and (2) a still more staple type which does not decompose until the temperature exceeds 700°, when it yields mainly hydrogen. All coals of carboniferous origin—*i.e.*, ordinary bituminous coals and anthracite—contain these two types of constituents; and it may prove that the difference between the various classes of bituminous coals are largely due to variations in relative proportions of the two types of compounds which they contain. Also, it seems probable that the least type of compounds, whose decomposition is mainly responsible for the smoke produced when a fresh charge of fuel is added to a fire, have been derived from the resinous constituents of the original vegetable *débris*, while the more stable (or humic) type, whose combustion is smokeless, represent the degradation products of the original cellulose.

A separation of the two types of constituents may be effected by means of certain organic solvents. Some years ago, Professor P. Bedson, of Newcastle-on-Tyne, called attention to the remarkable solvent action of pyridine upon coal, and showed that if the coal be finely ground so as to run through a sieve of 1000 apertures per square inch, then mixed with sand and extracted with the solvent in a Soxhlet apparatus, a large proportion of the resinous constituents pass into solution. On evaporation of the solvent there remains a resinous residue which, as Dr. Wheeler has shown, is partly soluble and partly insoluble in chloroform. Thus it would appear that the coal substance may be divided into three parts—namely, a portion insoluble in pyridine (1), another portion soluble in pyridine but insoluble in chloroform, (2) and (3) a third portion soluble in both pyridine and chloroform. There is little doubt that while (3) represents the true resinous constituents, (1) represents the more stable humic bodies resulting from the degradation of cellulose. The precise nature of the intermediate second class is perhaps a little doubtful, and can only be cleared up by further research.

It has also been established that the resinous constituents, besides being relatively unstable, readily absorb oxygen at comparatively low temperatures, and that their extraction deprives the coal of its coking properties. Moreover, inasmuch as the coking properties of a strongly caking coal are known to diminish on prolonged exposure to atmospheric influences, it is fairly clear that the causes of intumescence and coking in certain classes of coal are to be attributed to the presence of the unstable resinous constituents which, on decomposition, yield paraffins and a pitchy cement, which acts as a binding material upon the residual humic bodies, and so plays a principal rôle in the ultimate formation of coke. It is also understandable why an oxidized coal seam is either non-coking or only feebly so.

Nitrogen in Coal.

Even a brief review as this of the chemistry of coal would be imcomplete without some reference to the occurrence of organic compounds of nitrogen and sulphur in the coal substance. Nitrogen, although present in coals to an extent of usually between 0·5 and 1·5 and at most 2 per cent., is a constituent of great economic value, inasmuch as it is the source of over 90 per cent. of the world's output of ammonium salts. According to the researches of Carrick-Anderson and Roberts, Hilgenstock, Christie, and others, the evolution of ammonia when coal is distilled, which begins at 330° in the case of gas coal and at 450° to 480° in the case of anthracites (the older in geological age the higher the temperature), reaches a maximum between 500° and 700°, and ceases altogether at about 900°. This ammonia probably arises from the decomposition of organic compounds, probably of an imino type, which are normally present in small amounts of all classes of coal. A very large proportion of the nitrogen, however, remains behind in the carbonaceous residue in coke, from which it is expelled as gaseous nitrogen as the temperature is raised from 900° to 1900°. Hence it would seem that nitrogen exists in coal in two forms—namely, (1) as compounds of an imino type, which decomposes below 900°, yielding ammonia, and (2) in a more stable nitride form.

In the actual distillation of coal on a large scale, whether in gas-works or in bye-product coking-ovens where ammonia recovery is carried out, it rarely happens that the yield of ammonium sulphate exceeds 30 lbs. per ton of coal, even though the latter may contain as much as 1·5 per cent. of nitrogen. Such a yield corresponds to about 20 per cent. of the total nitrogen content of the coal. The actual distribution of the nitrogen among the products of the distillation on a large scale is somewhat as follows:

	Per Cent.
As N in coke	40 to 50
As N_2 in gas	20 to 40
As NH_3	15 to 20
As organic basis in tar	3 to 4
As cyano compounds	1 to 2

A much larger quantity of ammonia may be derived from the nitrogen in coal by gasifying it in a generator of the Mond type in a superheated air-blast saturated with steam at 85° C. By such means as much as 80 to 90 lbs. of ammonium sulphate per ton of a suitable coal may be recovered, together with about 150,000 cubic feet of a gas containing approximately:

$$CO_2 = 17{\cdot}0,\ CO = 11{\cdot}0,\ H_2 = 24{\cdot}0,\ CH_4 = 3{\cdot}0,\ N_2 = 45{\cdot}0.$$

Although the capital cost of an ammonia recovery gas-producer plant of the Mond type is large, it is, nevertheless, a most scientific and economic means of utilizing coal for the production of gas for power and other large-scale industrial purposes.

Sulphur in Coal.

Sulphur is always a deleterious element in coal from every point of view. It exists chiefly in three forms—(1) as iron pyrites (FeS_2), (2) as gypsum (CaSo4), and (3) in the form of organic compounds in the coal substance itself. On carbonizing a coal in gas-retorts or coke-ovens, between a quarter and a third of the sulphur is expelled, chiefly as H_2S, CS_4 and thiophene, with the gases—the remainder being retained by the coke.

Want of Scientific Research.

In concluding my review of the present state of science concerning the chemical nature of coal, I must once more call attention to its incompleteness and the need of much more systematic research on the subject. Chemically speaking, coal is a substance of great structural complexity, and we hardly know anything at all about either the precise nature of its various constituents or their modes of decomposition by heat. It is true, of course, that we have gained considerable experience as to the yields of the various products (solid, liquid, and gaseous) obtained when bituminous coal is distilled under given conditions; but as to how they arise, we know practically nothing.

If anyone is inclined to question the justice of this statement, I will put to him one question. For the supplies of the high explosives which are essential to the successful prosecution of the war, we depend entirely upon the benzene and toluene obtained by the distillation of coal; and, according to our present methods of carbonization, the amounts of these products obtainable per ton are strictly limited. I would therefore ask whether anyone, from ascertained knowledge of how benzene and toluene are actually produced in the distillation of coal, can propose any certain plan or method for increasing the yields of these important substances. Can anyone, for example, suggest a plan for doubling the best yields hitherto obtained?

If, as I am afraid, such scientific knowledge or experience is not at the present moment forthcoming, we stand branded as mere empirics in a matter which is so vitally important to final success in this war. I am afraid I must also say that, in my opinion, the Ministry of Munitions, of whose activities we hear so much, have been guilty of culpable negligence in that they have so far disregarded all warnings and representations concerning the importance of organizing some competent chemical supervision of bye-product coking plants from the point of view of improving the yields of benzene and toluene, and that if we fail, as we may do, in keeping up adequate supplies of high explosives, it will be very largely for want of knowledge and insight on the part of those who have taken upon themselves the responsibility of organizing these supplies.

But, looking beyond the war to the period of economic recuperation, which will try our mettle even more than the war itself—two things above all are needed as a basis for the scientific utilization of our coal and the realization of all possible economies in regard to fuel consumption. The first is a systematic investigation of the chemical nature of coal, which may best be undertaken by a selected group of experienced chemists aided by adequate grants from public research funds. The second is a chemical survey of the principal British coalfields, which ought to be organized by a public Department, acting in conjunction with the laboratories which have been established for the special study of fuel technology at the Universities and other institutions for advanced research in applied science. We already have in the country all the means, as regards men and equipment, for the work; and it only remains for the authorities who administer money voted by Parliament for scientific and industrial research to provide adequate grants for its effective prosecution.

BUSINESS IN ENGINEERING.

That engineering, as it is known to-day, could not exist without its commercial side, was the argument advanced by Mr. F. G. Hatch, in a paper which he lately read before the Junior Institution of Engineers. In the ordinary course of things, an article has first to be designed; then the material to be worked upon must be purchased; next processes on the material are required, to form a manufactured article; and, lastly, the product must be sold and properly exploited. Commercial considerations must enter very largely into the question of design and manufacture; and technical excellence must be given due weight in the buying of raw material and the selling of the finished article, if all-round success is to be attained. This is an aspect of their work which Mr. Hatch thinks is not sufficiently borne in mind, especially by the younger engineers; and he warns them that the present is a commercial age, and it is inevitable that anyone failing to combine business ability with technical skill is doomed to limited advancement. It is of the utmost importance, therefore, that engineers should be good business men. To assist towards this end, the suggestion the author made was that the usual routine of practical training might well be varied. After the customary round of the shops, some time might be spent in the general offices—commencing (say) in the accountant's department—followed by a period in the costing office, then in the estimating department, and finally in the drawing office. The value of this business interlude, after the practical work of the shops, would, he says, seem to be very great. For one thing, it would give those whose inclinations lay in the direction of a business career a chance to find themselves in a position where this would be noted. Thus the business and commercial positions could gradually be filled by men who had commenced their training as engineers, and who would be regarded by their technical associates as in the same profession as themselves.

The Treasury has re-appointed Mr. W. A. Schultz, J.P., F.C.A., to act as a Public Auditor for the purposes of the Friendly Societies Act, 1896, and of the Industrial and Provident Societies Act, 1893 to 1913, for the year ending Dec. 31, 1916, for the United Kingdom.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

Visit to the Johnstone Gas-Works.

Last Saturday, members of the Association to the number of about seventy visited the Johnstone Corporation Gas-Works. They were met by Mr. James Dickson (the Engineer and Manager), who showed them a plan of the works, and explained the general idea on which they were laid out, and the provision made for extension.

The retorts are of the Wilson-Glasgow vertical type, with a capacity of 550,000 cubic feet per day. Unfortunately, the size of the condenser and scrubber plant is less than this; and they sometimes had gas containing tar reaching the purifier. The capacities of the two holders are 350,000 and 250,000 cubic feet respectively. A tar-dehydrating and benzol-recovery plant has been installed, and has worked very satisfactorily on the first trial which they have been able to make with it.

The party were conducted over the works, after which they went to the Town Hall, where they were welcomed by Provost Armour and entertained. In the course of his welcome, after apologizing for the absence of Provost Lang, who was away on business as a member of the Munitions Committee, Provost Armour gave a short account of the progress made in Johnstone. In spite of their recent high capital expenditure, he said, they had reason to be proud that they could sell gas cheaper than most. It was only 1s. 10d. per 1000 cubic feet, but had, owing to recent advances in the price of coal, to be raised to 2s. 4d. They were progressive in Johnstone, and were looking ahead; and within the last year they had spent over £2000 in laying mains to the village of Howood. They did not expect an immediate return for this outlay; but they had got their gas into Howood, and anticipated a good result in years to come. He was glad to say Mr. Dickson enjoyed the full confidence of the Council, even although they required of him the why and the wherefore of all he proposed.

Mr. David Fulton (the President) replied, and was followed by Bailie Aitken, who said that things were very much changed from the time when he first entered the Council. Then, the Council looked askance at delegates and meetings of the kind they had the pleasure and opportunity of entertaining that night. Now, he was glad to say they had adopted a more enlightened policy. They welcomed such meetings, because they recognized that the visitors were bent on the serious business of making themselves conversant with as many modern methods as possible. The members advantaged by such visits; and they carried the ideas obtained into their own works, and thereby benefited the corporations or companies who employed them. He was also glad that they were able to entertain them, because it was his opinion that the development of better social intercourse between officials of different corporate bodies was as much for the good of the employers as for the employees. He would like to pay Mr. Dickson the same compliment as the Provost; for Mr. Dickson had proved himself a worthy successor to those who had preceded him.

A very pleasant evening was spent with song and story.

Laying Mains Under Water.

A recent issue of "Engineering News" (New York) gave an illustrated account of the laying of a new 36-inch cast-iron waterworks intake at Quincy, Illinois, to replace a 30-inch wood-stave pipe-line. The initial operation in the laying of the pipe was to place four 12-feet bell-and-spigot lengths on skids, parallel to the shore line, and connect them by ordinary lead joints caulked by pneumatic hammer. These 48-feet sections were made up with a 6-inch bell forward, and a machined spigot at the rear end. A bead had been cast on the pipe 18 inches from the special spigot. The lead joint was poured into the 6-inch bell around a cast-iron form turned to the exact shape and size of the machined spigot; and after the lead had set, the form was removed. Heavy steel clamps were bolted around the pipe, back of the forward bell and around the bead on the spigot end. When a section was to be taken out for laying, a large scow was anchored with the A-frame derrick over the section to be hoisted. Two hitches were taken around the pipe, which was hoisted off the skids; and the scow was pushed out to an anchorage over the site. When the trench was reached, the section was lowered; and with the help of a diver the spigot end was led into the bell of the preceding section. Bolts were passed through the clamps bolted around the bell and spigot; and by tightening the nuts on the bolts, the spigot was forced into the cold lead in the bell. A diver then caulked the lead around the pipe with a pneumatic hammer. The clamps and bolts were left on the pipe to strengthen the joints. No backfilling had to be done, as the sand drifted into the trench quickly; and within a few hours the pipe was entirely covered.

Mr. A. K. M'Cosh, ex-Provost of Coatbridge, died on Saturday at his residence, Cairnhill, near Airdrie. He was head of the firm of Messrs. William Baird and Co., of the Gartsherrie Iron-Works, and was widely known throughout the iron and products recovery trades.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

German Enterprise and "French" Pipes.

Sir,—It will, of course, be a matter of common knowledge to your readers that during the last ten years a large and constantly increasing quantity of (so-called) French pipes have been used in this country, particularly by gas and water engineers. The reasons for this were: (1) The cost compared favourably with that of English pipes; (2) they were cast vertically; (3) they were supplied in 3 or 4 metre lengths, even in smaller diameters (below 6 inches).

One of the principal sources of these pipes was "La Société Metallurgique d'Aubrives et Villerupt," whose foundry at Aubrives was visited by the British Association of Water-Works Engineers (now the Institution of Water Engineers) in the year 1904.

The popularity of these "French" pipes has no doubt profited by the "*Entente Cordiale:*" and, as a result of the present war, it is probable that their popularity will be greater than ever—assuming that they are again offered on the English market on similar conditions to those prevailing before the war.

With this prospect in view, it seems well worth while to reveal certain facts the writer has just gleaned from a French book entitled "L'Allemagne en France" by Louis Bruneau [Librairie Plon, Rue Garanciére, Paris]. This book explains in detail the procedure adopted by German metallurgists, ironmasters, &c., to secure the control of the French iron mines and foundries. The opportunity for this procedure has arisen in the first place from the fact that France is well provided with iron ore, but is deficient in coal; while the reverse is the case in Germany. Collaboration on equal terms would no doubt have been possible, and would have been a mutual advantage to both countries; but the superior methods adopted by German firms, in regard to finance, administration, and efficiency and economy of manufacture, have enabled them in process of time to gradually but completely monopolize the control of the French companies. The means adopted towards this end have been thoroughly German—that is to say, there has been plenty of business "smartness," but a marked absence of commercial honesty.

It is not, however, the purpose of the writer to retail the contents of this book in the form of a letter, but to direct your readers' attention to the fact that the Société Metallurgique d'Aubrives et Villerupt is at the present moment controlled by the German Trust "Gelsenkirchen" and its very influential head, Herr Thyssen. It is therefore to be noted by all English gas and water authorities and engineers that, in placing orders with this firm, they have been benefiting Germany rather than France—at any rate, since the year 1909, when the German control was consummated.

At the present moment the Aubrives mines and works are, the writer believes, in the hands of the German troops; and it is impossible to foresee what will happen to them by the time the war is over. But unless and until these and other French pipe foundries are released from German control, all English engineers should be urged to avoid (so called) French pipes at any cost.

Anti-Germanicus.

Jan. 18, 1916.

Labour and the War.

Sir,—There must be a number of men who were employed in gas-works who have done their "bit" in this disastrous war, and having been partially disabled, and unfit for further military duties, are quite capable of carrying out the duties of stoking machine drivers, telpher drivers, and carburetted water-gas operators. I would suggest that steps should be taken to get a record of these men, so that they could have preference when any vacancies occur.

The reading in the technical papers of the numerous strikes and labour troubles in these times is very distressing; and it is to be hoped that they are caused in most cases by the very unsatisfactory substitutes which the different works have had to put up with. It is, to say the least, very galling to see a number of young men of military age at different works taking advantage of the present shortage of labour to press unreasonable demands—trusting to the shortage of labour and a war badge to prevent their being enlisted. Most undertakings would prefer to give extra remuneration to those who answered the country's call in her time of need, and dispense with the unsatisfactory labour of the slackers, who will neither carry out their work satisfactorily nor do their "bit."

Register.

Jan. 18, 1916.

The Jarrow Train Disaster.

Sir,—For some weeks past I have read with interest the correspondence upon the Jarrow train disaster, and certainly think that many of the remarks relate to a matter of opinion, based upon circumstances which generally exist in such disasters.

The engineers and witnesses did not state that they know for certain the prime cause of the fire. I have been told, in good faith, that wax vestas packed in parcels in the mail bags being sent away to H.M. Forces were the cause of the fire, and that these became ignited when the impact was felt.

This was quite obvious upon examination of the mail bags. The smell of these matches in mail packages is of frequent occurrence, and discloses the nature of the contents. If this statement is correct, it is surprising that nothing has been said upon this particular point. It may possibly help to remove some of the blame put upon the gas apparatus.

We should always try to remember that both gas and electric light have their uses; but we should be fair, and get the true cause of the fire, then fix the blame.

Chris. J. Stiff.

115, *Stockwell Road, S.W., Jan.* 21, 1916.

Increased Toluene Production.

Sir,—In the coal-liming experiments, the coke was quenched without delay, in the usual manner—using a quencher and hose pipe. Hence, the obvious presence of lime must be due to the oxidizing action of generated steam.

The whole theme of the article in question was centred on lower carbonizing temperatures being conducive to increased toluene production; and no special working temperature was advanced, the figures relating to the yields of aromatics under various thermal conditions being given.

The results of coal-liming at a gas-works were taken from the "Gas Chemist's Summary," 1913; and should Mr. Beeston care to turn to them again, he will find the "percentage of lime added," where his calculation is based on the assumption that limestone was used.

A theoretical calculation on the lime basis gives a figure which approximates to the ash content quoted; the slight discrepancy allowing for sampling errors.

B. Dunglinson.

Jan. 22, 1916.

Price of Heavy Naphtha.

Sir,—With reference to the price of heavy naphtha as given in the "Journal" for the past few weeks. This is quoted by you as 1s. 2d. to 1s. 3d. per gallon, which we consider altogether out of it as far as the actual market value is concerned. And very misleading indeed. Our own experience is that we have not the slightest difficulty in getting anything from 1s. 9d. to 1s. 10d. Also we cannot buy any at less than these prices. We should like to hear from any other firm who can buy this article at the prices you quote. We presume that the price is arrived at from actual sales—say, during the past month. However we should be agreeably surprised to hear that it is possible to obtain this article at the "Journal" price.

E. Hardman, Son, and Co.

Hull, Jan. 20, 1916.

REGISTER OF PATENTS.

Gas-Purifiers.

Milbourne, R. J., of Donnington, near Newport, Salop.

No. 2768; Feb. 20, 1915.

The patentee proposes to employ a junction-box, composed of two cylindrical chambers or pipe sections which communicate with the upper and lower sides of the purifier and with a space between their adjacent ends, in which is a disc-valve surrounded by a casing connecting the two cylindrical chambers or pipe sections, and in connection with which is the junction-piece for the gas-main. The valve seats against the end of either of the chambers or sections in such a manner that, when the valve is in contact with one seat, the flow of gas will be cut off from one end of the junction-box, and will be allowed to flow through the other end of the junction-box from the inlet. If the valve at the inlet end of the purifier is in a position to shut off the gas from the upper part of the purifier, and the other valve is open to the upper end of the purifier, the gas flows through the purifying material from the bottom upwards; but if the positions of these two valves are reversed, the flow is in an opposite direction.

Fig. 1 is a sectional elevation of an inlet valve and parts in connection with one end of a purifier. Fig. 2 is a front elevation. Fig. 3 illustrates a modification.

In figs. 1 and 2 A B are the upper and lower cylindrical chambers or pipe sections in communication at their outer parts through the openings C with the upper and lower sides respectively of the purifier. The casing is rectangular in shape, and into it the inner or adjacent ends of the chambers A B open. E is the gas inlet fitted to the casing D. F is the disc-valve within the casing between the inner or adjacent ends of the chambers A B; while G are lateral guiding lugs upon the valve which engage with the guides H in the casing D to ensure the proper application of the valve on the seats.

When the valve F is seated on the chamber B, by turning the spindle I the gas to be purified enters the inlet E and passes into the chamber A, whence it issues, through the openings C, into the upper part of the purifier. It then passes downwards through the purifying material to the outlet valve—of similar construction to that shown, but in which its valve F is seated against the upper chamber, so that the gas enters the chamber B and thence passes to the outlet branch E. By reversing the positions of the inlet and outlet valves the gas is caused to pass through the purifier from below upwards. M is a lateral hole in the casing D, closed by a cover which serves for the removal of the disc-valve for repair or any other desired purpose.

In the construction shown in figs. 1 and 2 the gas to be purified enters and leaves the purifier laterally. Where it is desired that the gas shall enter and leave through the bottom of the purifier, the rectangular casing D is furnished, as shown in fig. 3, with an additional box O, which forms a passage from the opening P in the bottom of the purifier to the casing D.

The patentee points out that not only is it possible by his invention to cause the gas to be purified to flow through the purifying material of any purifier either in an upward or a downward direction at will, but also the same regulations may be effected in any individual purifier of a set, so that the gas can pass upwards through the purifying material in one purifier and downwards through the material in the others of the set.

Fluid-Meters.

Hodgson, J. L., and Gray, F., of High Holborn, W.C.

No. 21,258; Oct. 20, 1914.

The object of this invention is to provide simple means for measuring a pulsating flow, but is applicable to the measurement of steady flows —the meters being of the type in which the measurement is obtained from the movements of a hinged flap moved by the passage of the fluid to be measured.

The patentees claim; (1) In connection with fluid-meters, a method of measuring the true mean value of a pulsating flow of any periodic wave form by obtaining a motion proportionate to the flow and conveying this motion to a damped pointer through a flexible coupling, so designed that the force exerted between its two parts, when these are relatively displaced, varies according to a law which is so related to the law of damping that at any instant the rate of motion of the pointer is proportionate to the amount of relative displacement of the two parts of the coupling. (2) In connection with meters of the hinged-gate type, methods of obtaining a movement of the gate approximately proportionate to the flow. (3) In connection with meters of the hinged-gate type, and with meters which measure the flow in terms of a differential pressure in which a movement approximately proportional to the flow is obtained by means of shaped floats and bells, the method of obtaining an indication of the true mean rate of flow when measuring on a pulsating load by transmitting a motion which is proportional to the flow at every instant through a hair spring to a pointer, the motion of which is damped by one or more vanes moving in oil.

Inverted Incandescence Gas-Lamps.

Grob, H., of Zurich, Switzerland.

No. 1360; Jan. 27, 1915.

This invention relates particularly to lamps for use in railway carriage compartments and as head-lights for locomotives.

The patentee claims as his invention: An inverted incandescence gas-lamp for use with high-pressure gas having the incandescent body surrounded by a heat-resisting body, consisting of a quartz capsule of approximately the same shape as the incandescent body and the inner diameter of which is such that the burned gases, passing through the incandescent body, travel freely upward, but small enough to retain the heat of the flame. A suitable diameter is said to be three times the radius of the incandescent body. The quartz capsule has a light absorption capacity of 10 to 25 per cent., and is of such a thickness that the

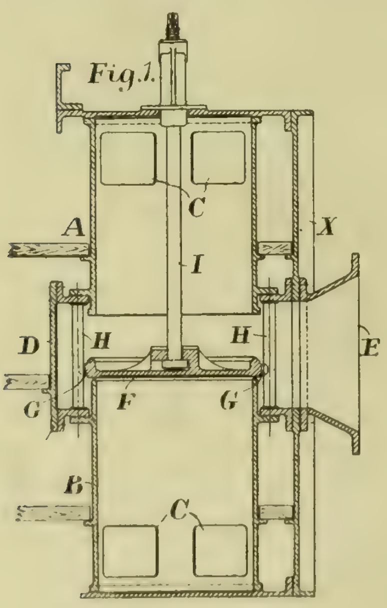


Fig. 1.

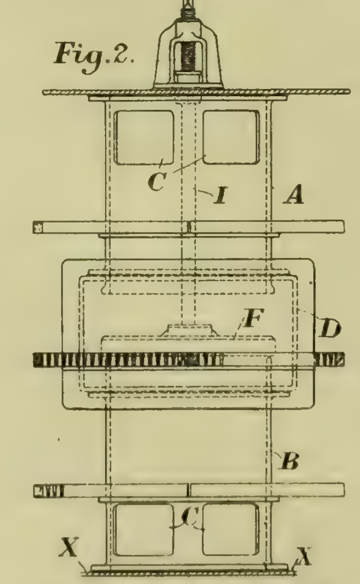


Fig. 2.

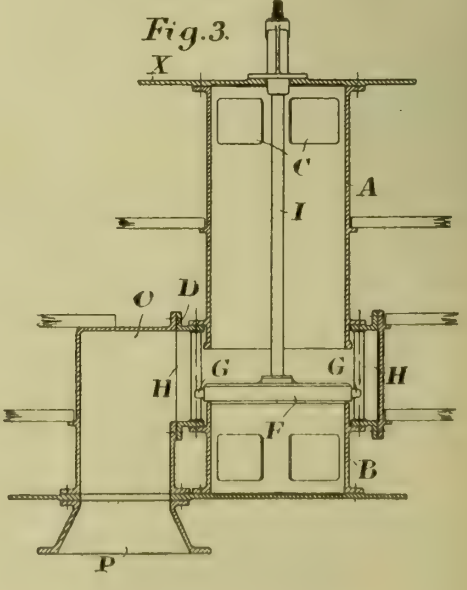


Fig. 3.

Milbourne's Gas-Purifiers.

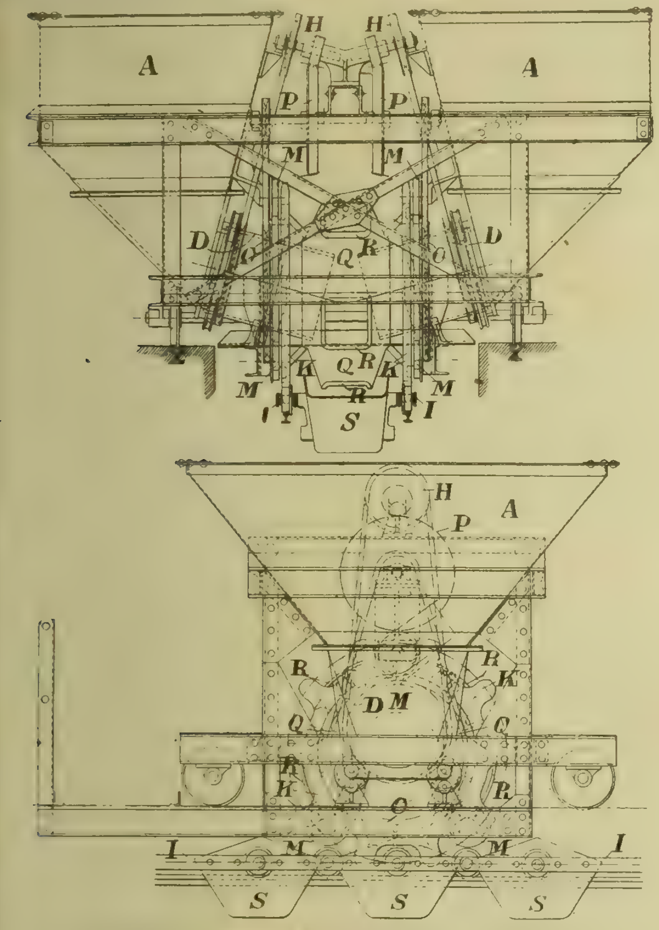
quantity of light absorbed by it is "at least replaced or balanced by the increased illuminating power resulting from the increased temperature of the incandescent body."

Discharging Coke-Hoppers.

Duckham, A. M'D., of Ashtead, Surrey.

No. 85; Jan. 2, 1915.

In this apparatus for discharging coke-hoppers, the discharge shoot is a cylinder rotating on its axis—inclined at such an angle as permits the discharge of the coke when the cylinder is set in rotation, but not when it is stationary. Owing to the rotation, the coke travels downwards, and "is delivered without the breaking action which is inseparable from a worm conveyor." When used in conjunction with a bucket conveyor, the latter drives the cylinder, and an intermediate revolving shoot receives the coke and discharges it into the conveyor buckets as they arrive in turn below it.



Duckham's Apparatus for Discharging Coke-Hoppers.

This construction is illustrated (as applied to two hoppers adapted to collect coke from gas-retorts) in end and side elevation.

The hoppers A are mounted in a frame which runs on rails at the sides of the conveyor pit. The inclined cylinder D, which forms an extension of the lateral discharge opening of the hopper, is mounted at its inner end on four rollers carried by the hopper, and at its middle on two rollers carried by brackets on the framing. It is driven by a belt from a pulley H—itself driven from the conveyor chain I in the following manner: The chain engages a toothed ring K surrounding the cylinder D and provided with a bearing ring whereby it is carried on three rollers M—one mounted on brackets on the hopper and the others on the bottom member of the framing. To the bearing ring is fixed an annular belt pulley O, through which is driven the shaft of a gear wheel P engaging a toothed wheel on the shaft of the pulley H. Co-axial with the toothed ring K, and fixed to it, is a drum Q having on its periphery five discharging mouths R. The drum Q acts as an intermediate shoot, and the pitch of the ring K is such that as each discharging mouth turns into its lowest position there is a bucket S in position to receive the coke.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Export of Incandescent Gas-Mantles.

Mr. Joynson-Hicks last Wednesday asked Mr. Bridgeman (as representing the War Trade Department) whether, in the list of prohibited goods issued by the Department on Nov. 29 last, there was no prohibition of incandescent gas-mantles, but their export was prohibited without a licence because they were dipped in thorium, which was a prohibited article.

Mr. Bridgeman replied that the answer was in the affirmative. The classification of prohibitions was being considered at the present time, and it was intended to make such improvements therein as were possible.

LEGAL INTELLIGENCE.

LEISTON PUBLIC LIGHTING CONTRACT.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Saturday, Jan. 22.

(*Before Mr. Justice* Low).

Leiston Gas Company, Limited, v. Leiston-cum-Sizewell Urban District Council.

This action, which raised a question as to the liability of authorities in respect of public lighting contracts, having regard to the regulations under the Defence of the Realm Act, was originally set down for hearing as a short cause. When, however, the case came before his Lordship [see "Journal" for Dec. 21, p. 651], he remarked that it might raise points of far-reaching importance, and he should not try it as a short cause. The action was ordered to stand over until the present sittings; and he heard the arguments on Saturday—reserving judgment at the close. The Company claimed £157 15s. 9d. for services rendered to the Council under a contract entered into in 1911. The defendants denied liability, on the ground that the Company had not supplied gas during the period for which they claimed, in consequence of an order made by the military authorities.

Mr. Matthews, K.C., and Mr. Rayner Goddard were for the plaintiffs; Mr. Hawke, K.C., and Mr. Poyser, for the defendants.

Mr. Matthews, in opening, said that the Gas Company were claiming £157 15s. 9d., being three quarterly sums payable at the end of March, June, and September, 1915, under a contract in writing dated June 2, 1911. The short point in the case was one with which nearly everyone, particularly Londoners, had become unhappily familiar, on account of the decreased lighting. From Jan. 1 to 24, only 26 lamps out of 107 were allowed to be lighted; and after the 24th no lamps at all could be lighted in the district. The case for the Council was that the orders made under the Defence of the Realm Act had prevented the performance of the contract, and that therefore the payments agreed upon were not due; but the Company's contention was that the orders had only hindered or temporarily impeded the performance of the contract.

His Lordship: I have read the contract; and it is not only one to supply gas. There are standards and other things to be provided.

Mr. Matthews replied that it was a contract for five years at least; and the Company had to erect, fit up, and connect with their mains over a hundred standards. They expected to recover their initial outlay by the contract running over a period of at least five years. That which had happened had in no way interfered with the obligation of the Company, for instance, to clean, repair, and maintain the lamps. In the event of the case being decided in favour of the Company, there was no dispute about the facts or the sums claimed.

Mr. Hawke (for the Council) stated that the district had been in darkness since Jan. 24, 1915; and yet they were asked to pay the Company £157. Mention had been made of the gas-standards. They were erected to illuminate, not to beautify, the locality; and he submitted that the contract was essentially one for lighting. If, then, illumination became illegal, the contract was at an end. The Council never contracted to pay for the lighting of Leiston when the lighting was prohibited by a higher authority. He argued that payment for lighting during a period when it was illegal to supply light could not be enforced.

His Lordship asked if there was any authority at all that a contract can be suspended.

Mr. Hawke said if his Lordship was against him on the point that the contract had been determined, he contended that the contract was suspended by order of the competent military authority; and that the Company in this case could not enforce payment for lighting during the period when it was illegal to supply the lighting.

Mr. Matthews, in reply, contended that the effect of a law which operated to the interference of a contract did not apply. The order of the military authority did not justify the Council in saying that the contract had come to an end. The fundamental proposition in considering the authorities his learned friend had quoted was whether the performance of the contract was interfered with by an act of God, by the Legislature enacting something which rendered it illegal, or by the action of the Executive Government which was binding on the parties. His Lordship must have regard to the length of the contract period, the question of whether the contract was capable of being performed, and the question of whether it had been put an end to by the circumstances which had arisen. His submission was that the contract was more or less capable of performance.

His Lordship: The contract provides not only for the supply of lighting, but for the provision, at the expense of the Company, of standards, lamps, and other things, and for the maintenance of the apparatus. It also provides for the payment; but it is impossible to distinguish the amount of payment, and how much of it is applicable to work done and apparatus supplied, and how much is applicable to consumable material supplied. This being so, one of the difficulties which has occurred to me is this: Are the Gas Company, because, through no fault of their own, they are unable for the present to go on supplying gas, to lose all the initial outlay which they have incurred in respect of the apparatus they have provided? If the proposition of the Council is a sound one, the Company on Jan. 25 could have removed all their plant, as their contract was at an end. Supposing the Local Authority had objected, on the ground that they were going to pay as agreed in the contract? Here we are dealing with a comparatively small place; but is it conceivable (say) in one of the Metropolitan boroughs, that, in such circumstances, they would allow the gas contractors to remove the whole of their plant from the borough, if they could help it? After further argument, his Lordship said he had no doubt which way his judgment would be; but as he wanted to look into the cases cited, he would deliver judgment in a few days.

MISCELLANEOUS NEWS.

ELLESMERE PORT GAS ARBITRATION.

On Monday of last week, at the Surveyors' Institution, Great George Street, S.W., the hearing was commenced of an arbitration between the Ellesmere Port and Whitby Urban District Council and the Shropshire Union Railways and Canal Company, to determine the price to be paid by the Council for the Company's gas undertaking. Mr. A. J. RAM, K.C., was the Arbitrator.

Mr. HONORATUS LLOYD. K.C., and Mr. A. M. PADDON (instructed by Messrs. Potts, Potts, and Gardner) appeared for the Shropshire Union Company; Mr. W. E. TYLDESLEY JONES (instructed by Messrs. Baker and Sons), for the Ellesmere Port Council.

First Day's Proceedings.

Mr. HONORATUS LLOYD, in opening the case, stated that the arbitration was taking place under the Council's Act of 1914, which confirmed an agreement made between the parties in that year. Under this Act and agreement, the Council compulsorily expropriated the Company of their gas undertaking; and though, no doubt, the ordinary principles which one was accustomed to apply to these matters would apply here to a great extent, there were certain things which were unusual, by reason of the fact that the gas undertaking which was being acquired was really a portion of a much larger concern—the Shropshire Union Railways and Canal Company's undertaking. The agreement provided for the sale of the works and plant, but not for the site on which the works were erected. There was also excepted from the sale all pipes, meters, lamps, and fittings on the Company's premises provided for the Company's own use. The Council were, within six months of the transfer day, to remove from the Company's premises all the works and plant included in the purchase, making good any damage caused in so doing. The Company were to be entitled to all rates, rents, and profits accrued due, and to discharge all liabilities up to the transfer day; incomings and outgoings being apportioned as far as might be necessary. The Company were until the transfer day to carry on the undertaking according to their usual course of business, and to give to the Council all reasonable facilities for connecting, altering, renewing, or repairing the mains and pipes, whether before or after the transfer day, as might be necessary to secure that there should not be any avoidable interruption in giving a supply of gas to consumers within the district of the Council. The day appointed for the completion of the sale and the payment of the consideration was fixed at nine calendar months after the giving of the Royal Assent to the Bill [the Royal Assent was on July 31, 1914]; "and if from any cause all or part of the consideration payable by the Council to the Company on that day shall not be so paid, the Council shall pay to the Company interest after the rate of 5 per cent per annum on the moneys remaining unpaid from the transfer day until payment thereof." If from any cause the purchase was not completed on the transfer day, the Company were to carry on the undertaking and retain the profits; the Council indemnifying them against all liabilities. The purchase of the undertaking was to be deemed to be a compulsory one. Until recently, the district would have been described as lying on the banks of the Mersey; but when the Ship Canal was made, it was constructed so as to intervene between the Mersey and the main part of this district. The Company obtained their statutory powers in 1913, and owned just over 200 miles in length of canals. In the Ellesmere Port district, the Company had docks, quays, warehouses, &c. Of course, the canal business grew from time to time; and in 1863 the Company established gas-works for the purpose of supplying themselves. The Company were, however, asked in the following year by a number of people who lived in the district to give a public supply of gas, and this they did, at the same time making provision for furnishing some of the public street lighting. The population of Ellesmere Port then consisted very largely of the employees of the Company. When, about 1892, Wirrell became an urban authority [Ellesmere Port was a parish inside the Wirrell area], in regard to the lighting of the streets of Ellesmere Port, they applied to the Company to give them a supply of gas for street lighting. This being so, the Company thought it wise to make it quite clear that they had power to supply gas and to charge for it; and therefore in the London and North-Western Railway Bill of 1893 they inserted a clause conferring upon them powers to give a supply.

The ARBITRATOR: What was the connection between them and the London and North-Western Railway?

Mr. HONORATUS LLOYD replied that the Company were leased in perpetuity to the London and North-Western Railway Company. The clause provided that the Shropshire Union Company should not, by virtue of the powers thus conferred upon them, be deemed to be a company empowered by Act of Parliament to supply gas within the meaning of section 3 of the Gas and Water Works Facilities Act, 1870. In 1902 Ellesmere Port was made an urban district; and the public supply was still given to them by the Company. A new agreement for this was come to in 1907; and during its existence—certainly from 1907 to 1913—considerable extensions were made by the Company at the request of the Urban District Council. Then followed the negotiations which ended in the Act to which he had already referred. Ellesmere Port itself had gone ahead very rapidly; for it had now many advantages for commercial purposes. The population in 1901 was 4275; and ten years later it was 10,366, while for 1914 the estimate was 12,000. In like manner the rateable value, which in 1903 was £14,221, had risen to £52,370 at the present time. There were 191 gas consumers in 1904; in 1914, there were 959. Of course, it went without saying that, had the undertaking been left in the Company's hands, it must have had a very substantial future before it. There were a great many houses available to become gas consumers—something over 1400 not yet using it. The undertaking was probably more valuable to the Company than it could be to the Council, because they had the opportunity of getting materials in the very cheapest market, and so could carry on the concern much more economically than the Council could ever hope to do. There might be some dispute as to which was the proper year to take for capitalization. They were now affected by the war; but this check was not going to be a permanent one. Though there was a set-back for the moment, it was a set-back due to circumstances with which they were all unfortunately familiar. In this case it was not a very big set-back; but at the same time it would not be fair to take as a standard or normal year to capitalize a period such as the present, when these conditions existed. If the Arbitrator took the year 1913, which he was going to submit as a normal standard, the Company would show a profit upon the trade they had done, apart from the trade with themselves, of just over £1800. From the supply to themselves, reckoned as a bulk supply, at a discount of 15 per cent., and a further 5 per cent. for cash, in 1913 the profit would have been £379. When necessary deductions were made, the maintainable revenue arrived at was in round figures £2100, to which they suggested 22¼ years' purchase should be applied. There would be a claim in respect of surplus works of a little under £2000. Then there were the officials. The Company had no separate staff for the gas undertaking; and the result was that, taking the higher officials, they would be landed in the general undertaking with certain costs in connection with the salaries of these officials, for which no provision was made. This, taken at ten years' purchase, they put at about £1800. Then there was the capital expenditure of £535 which had been incurred since 1913. The Council were not to have the site, but would have to build new works elsewhere. As, however, the purchase was a compulsory one, what had to be considered was the value of the undertaking to the Company; and the Council were not entitled to any allowance by reason of having to build new works. The amount deducted in respect of the land was £200. In round figures, the total figures arrived at by his two witnesses were £55,000 and £53,000 respectively.

The following evidence was called on behalf of the claimants:

THE ACCOUNTS.

Mr. *William Cash*, examined by Mr. PADDON, stated that he had examined the accounts and other matters material to the inquiry. No absolutely separate set of accounts had been maintained in respect of the gas undertaking. There were separate records, for instance, of the revenue receipts; and the wages were allocated separately where the men were directly employed on the gas-works. But there had been no making up of a set of gas accounts; and therefore the figures had had to be abstracted from the general books of the Company. He had, however, been able to make a satisfactory abstract, and had submitted the figures to Mr. Keen, who was acting for the Council. In fact, the accounts were agreed, subject to observations upon them, and to certain questions of principle. Up to 1913, the figures reflected normal working. The houses supplied with prepayment meters were not fitted up by the Company. That was to say, there were no fittings; and this would make a considerable difference in the matter of repairs. The gas used by the Company for their own purposes had been calculated at cost in his tables; and if any alterations were made—if there was an additional charge put in under any one head—this, of course, would run the cost up, and a proportion of the additional cost would fall on the gas used by the Company. Some allowance ought to be made under the head depreciation of stoves. At 7½ per cent. on diminishing value in 1913, the figure would be £35 or £36. There was an item in the accounts for the first half of 1915, which had been compiled at the request of the Council: "Prepayment meter shortage, £169 13s. 7d." When the figures were gone into, it was found that the quantity of gas sold according to the meter readings did not correspond with the coins taken from the prepayment meters. He had no doubt the gas was actually supplied; but there was this discrepancy, probably extending back into the previous year. The leakage had been brought down; and the number of consumers had been steadily growing of late.

Cross-examined, witness said that, as the London and North-Western Railway were the lessees, it was no doubt a fact that the capital expenditure, at any rate of recent years, in respect of the gas undertaking, appeared only in that Company's books. It would mean a lot of work to pick out all the figures; and consequently they had not before them what would in the ordinary sense be a capital account. In 1911, the price of gas to ordinary consumers was 3s. 9d. and 4s. per 1000 cubic feet, less a discount of 5 per cent. for payment within a month. The price was reduced in 1913 to 3s. 6d. and 3s. 9d.; and the revenue went up. The usual tendency was for a reduction in price to stimulate consumption; and to a certain extent conversely, an increase in price tended to restrict consumption. In 1914 the revenue from the supply to private consumers fell slightly; but, on the other hand, the prepayment consumers yielded a much larger revenue. As a matter of fact, the number of prepayment consumers had increased in 1914 over 1913 by about 93. The consumption per consumer was slightly less. In 1911 and 1912, the price to ordinary consumers was 3s. 9d. and 4s., and to prepayment consumers, including meters, 5s. 2½. Thus, the addition for prepayment consumers was 1s. 2½d. per 1000 cubic feet. For 1913 and 1914, however, the extra charge was 5d. Considering the consumers were not getting internal fittings, the charge of 1s. 2½d. was distinctly high. He did not know how the reduction was brought about.

Mr. TYLDESLEY JONES: Is it not exceedingly unusual to have the same price charged to the local authority for public lighting as to private consumers?

Witness: There is a difference of 3d. here.

No; the large private consumer pays 3s. 6d. per 1000 cubic feet. Is it not usual for a public lighting authority to obtain more favourable terms than such a consumer?—It is not unusual. Everything depends upon the particular circumstances and the particular terms of the contract. Going back a little, the price for public lighting was 3s. 6d., against 4s., for quite a number of years.

After 1914, when the power of determining the agreement came into force, is it, in your opinion, fair to take the price of 3s. 6d. as the price which the Local Authority would have continued to pay?—I do not see anything unfair.

The Local Authority, in fact, pay more than the private consumer, because the latter gets 5 per cent. off for payment within a month, and the Council get nothing?—Yes; that is so.

Cross-examination continued: The cost of the supply to the Company themselves was figured out at 2s. 1·19d. per 1000 cubic feet. There might be some expenses included, as it was reckoned on the total cost of gas sold, which did not actually apply to the gas taken by the Company; but the amount would be very small. Repairs to mains on the Company's own premises would not be charged to the gas undertaking, but would be treated as though it was the Company's own work. It might be, taking the general accounts, that in some years the item of repairs needed adjustment.

Mr. TYLDESLEY JONES: If the Arbitrator is trying to ascertain the value of the undertaking on May 1, 1915, is it your suggestion that it would be fair to take as a typical year the year 1913 (a pre-war year) and capitalize that?

Witness: I think you must take the last normal working; but, of course, he will have in his mind the fact that the undertaking is affected by the war, and may be affected for some period yet by it, and that the payment is made under war conditions.

Do you suggest to the learned Arbitrator that in this case, in which he has to value the undertaking as on a certain day, he should put a higher figure upon the undertaking because there is a possibility that my clients will not be able to pay the purchase money immediately after the award?—Yes; I think so. It may not be within your power to pay, because you have to get the consent of the Treasury.

Mr. HONORATUS LLOYD: Perhaps it will assist matters if you will say whether your clients have got the consent of the Treasury to raise a loan.

Mr. TYLDESLEY JONES: We have got the Treasury consent to raise loans for our gas-works purposes; and we have, notwithstanding the war, borrowed a large sum, by means of which we have constructed our works. In this case, of course, we do not know what the award will be; and therefore we cannot apply.

Witness: Assuming that the Arbitrator took it into his mind that we could re-invest this money at 5 per cent., in round figures, and that the value after the war for similar investments would drop by ½ per cent., this, as a matter of simple arithmetic, would mean 2½ years' purchase. It is a question of what is likely to happen in this case. I should be afraid that you would be told by the Treasury that the matter must stand over, and that you must pay interest till a year after the war.

Mr. TYLDESLEY JONES: My proposition is going to be that, under this agreement, what is referred to the Arbitrator is to assess the value of the undertaking; and the question whether we pay to-day or to-morrow under the other clauses of the agreement, is not a matter which can be taken into account or is relevant.

Second Day.

Mr. *Cash*, re-examined by Mr. HONORATUS LLOYD, said the price charged for gas was not unreasonably high, having regard to the size of the undertaking. Here, there was no statutory limitation at all; it was merely a matter of commerce. In spite of war conditions, and so on, this undertaking had not raised the price of gas. In fact, in the year taken, the charge had actually been reduced. There was a great increase in the prepayment meter supplies; but as the Company did not provide fittings, or anything of the kind, this merely meant that they were getting a large demand, with payment in advance. In other words, they were getting all the advantages of the prepayment system without the disadvantages which usually accompanied it. If it was urged that the figures of profit on the working were abnormal, it must be remembered that this was an abnormal case, because of the way in which the concern was being carried on as part of the larger undertaking. It could therefore be carried on more profitably than if it had been an entirely separate concern. But, as a matter of fact, though the results were very good, they were by no means unprecedented. The case was not abnormal when compared with some of the smaller companies which had been considered good enough to be purchased.

ENGINEERING EVIDENCE.

Mr. *Henry Woodall*, in answer to Mr. HONORATUS LLOYD, said he had inspected the works, and made himself acquainted with the history of the Company and the position of the undertaking. No attempt apparently had been made to push the concern as a gas undertaking. He thought, generally speaking, they had given a supply when asked for, but they had not tried to push it. This was shown very largely by the fact that they had not supplied many stoves. This was a matter which had to be borne in mind, because where one found a business like this actually growing without any pushing, it tended to show what could be done with the concern if it were taken up as a separate undertaking. In this case, there were only 978 houses supplied, and there were 1437 without a supply. These other possible consumers were fairly near together. He believed the mains were arranged practically to supply them all. Originally, the works were put up to supply the needs of the Company themselves; and the people then asked for a supply.

Mr. TYLDESLEY JONES: I am going to admit at once that the Company have been asked from time to time to extend their mains; and they have complied. I have no complaint of any kind against the Company in supplying gas to Ellesmere Port.

Examination continued: There was very great room for extension here, no doubt. Having regard to all the circumstances, the price charged for gas was not unreasonable. The growth of the business had been very rapid. The sale of gas in 1904 was 7,890,000 cubic feet; and in 1913 it was 24,805,000 cubic feet. The increase in consumption in the nine years had amounted to 214 per cent.; and the compound increases per annum, to 13·57 per cent. The heavy increases had been since 1908. The private consumption had grown very much more rapidly than that of the Company. The war had, of course, affected the business to some extent. That the Local Authority had faith in the outlook seemed to be shown by their action in regard to their Act, in which they made provision for a considerable increase in the future. He understood that the works which had been built were capable of turning out something like 53 million cubic feet per annum, which was about double the maximum output up to date. The Act was passed just before the war; but the works had been built since. Though there was no doubt the earning capacity of the Company's works would have increased in years to come, he had in his valuation made no claim for the prospective value. All he did was to ask to be repaid for the works which were in excess of present requirements. He had taken the year 1913, as the last one unaffected by the war; and the profit was £1812. To this he added profit on gas used by the Company £379, and extra profit on ammoniacal liquor £72; and he deducted deficiency on amount spent on repairs and maintenance (1·51d. per 1000 cubic feet) £156, stove depreciation (5 per cent. on new value of £457) £23, and superannuation £6. This left the maintainable revenue at £2078, which he multiplied by 22¼ years' purchase, making £46,235. Adding to this 10 per cent. for compulsory purchase, gave a figure of £50,858. The further additions were: Surplus works, £1898; for severance, £1800; capital expenditure since 1913, £535. Then a deduction of £200 for the land gave a total of £54,891. To get at the real value of the undertaking, it was necessary to add the profit on the gas used by the Company. Later on they would be consumers of the Council. The addition for ammoniacal liquor was made because the sum actually received in 1913 was nothing approaching a fair average. The repairs charged in 1913 came to 2d. per 1000 cubic feet, which was very low indeed. He thought therefore it would be fairer to take four years and divide by the total gas sold during that period. The result was 3·51d. per 1000 cubic feet. Adding roughly 0·25d. for stove depreciation, gave a total of 3·76d. per 1000 cubic feet for repairs and maintenance. In the circumstances of the case, he thought this was sufficient. At all events, it was what had been spent; and it was supported by the expenditure that the London and North-Western Railway made under similar headings in connection with their two other gas undertakings. It was, of course, a distinctly low figure; but he regarded it as sufficient, taking all circumstances into account. In arriving at his valuation of the surplus works, he had thought it fairer to take the average of the maximum week, rather than the maximum day. In the case the retorts, retort-house, purifiers, and gasholders, there was a margin; and there was a slight deficiency in the condenser and foul main, Livesey washer, and station-meter.

Cross-examined, witness said he inspected the works in 1913; and they were fairly well conducted then. He would not say they were getting the best they possibly could out of them. Of course, he only went there for the purpose of making a valuation for the sale of the works. The Company did not consult him in any way as to the conduct of the works. In 1913, there was a reduction in charge as regarded the private consumers, and a much bigger one for the prepayment meter users; but the increased sales were certainly not entirely due to this. He would not describe the works as having plenty of spare room; they were rather congested so far as area was concerned. He had made a structural valuation of the works; and he put the property at the works and on the Company's premises (services and meters for their own supply) at £10,693. The property outside the Company's premises he valued at £5847. The £10,693 was the sum for which he reckoned that he could re-erect the works. He had not taken them as having depreciated. The same applied to the mains. The things were in good condition, and just as useful as if they were new. The length of mains was nearly 9 miles, and the number of consumers 968. For a works of the size, this was not a very low proportion of consumers per mile of main. The public lighting was often charged in these small undertakings at the same price as the ordinary consumers. If they could sell gas cheaper in the future, they would do so.

The ARBITRATOR: And if there is a reduction to the ordinary consumer, there will be a reduction to the Local Authority?

Witness: Yes.

Mr. TYLDESLEY JONES: If you had remained in possession of the undertaking, is it your view that the price for public lighting for the future would have remained at 3s. 6d.?

Witness: No.

Cross-examination continued: He had calculated the supply of gas to the Company's own premises at 3s 6d. per 1000 cubic feet, and deducted 20 per cent. for the bulk supply, making the charge 2s. 9·6d This was a reasonable figure. In the Model Bill they were not allowed to take off more than 20 per cent. No doubt if a larger sum had been spent on repairs and maintenance, there would have been a larger revenue. The sum actually charged was sufficient if they were content to earn the same revenue. Many gas companies spent 1s., and some 1s. 2d. per 1000 cubic feet, which really meant that they were building new works out of revenue. This he was not allowing for. The hypothetical figure for ammoniacal liquor was put in because there was a leak in the storage tank.

Mr. TYLDESLEY JONES: Supposing the concern was subject to the competition of another gas undertaking, would this affect the number of years' purchase?

Witness: It would reduce it.

Cross-examination continued: With reference to severance, he was claiming ten years' purchase of parts of salaries and other expenses, chiefly of people who were termed the higher officials. It seemed to him this was a very reasonable figure to take. He had never claimed such a thing before; but as a rule these officials went over to the purchasing body. There were, he thought, eight persons concerned.

Third Day.

Mr. *Woodall*, re-examined by Mr. HONORATUS LLOYD, said his view was that in future the price of gas would be lowered to everybody, public lamps as well as private consumers; but the present moment was distinctly not the time to reduce the price of gas, when the cost of all materials was so high. If the private lighting was kept at the existing price, it was not unreasonable the public lighting should be.

Mr. *E. H. Stevenson*, questioned by Mr. PADDON, stated that he had inspected the Company's works and accounts, and agreed with them that the circumstances made the position of the undertaking very exceptional indeed. While the Company, under the London and North-Western Railway Act of 1893, had certain parliamentary powers to sell gas and recover the money, they were exempt from all the obligations imposed by the 1871 Act on ordinary gas undertakings. This placed a special value on the concern. The owners had an absolutely free hand in every respect. There were five settings of retorts; and the quantity of gas required at present could be easily made with three settings such as there were there. The washer was the only item which was materially deficient on the works. The buildings were suitable for their purpose. The works had grown up bit by bit. Sufficient protection had been given to the different portions of the apparatus. Some parts were of wood, and some of corrugated iron; but this was fairly common with these small works. They were perfectly adequate for the maintenance of the income. In the course of his inquiries, he did not encounter any complaint on the score of price, quantity, or quality of the gas.

Mr. TYLDESLEY JONES: I am not making any complaint.

Mr. PADDON: Not as to price?

Mr. TYLDESLEY JONES: Only as regards public lighting. I accept the evidence Mr. Woodall gave, that this is priced a little above some other places in Cheshire.

Witness: I consider the price for public lighting is not unreasonable at all. The public lighting is not a very profitable undertaking. There are many cases where they charge the same price for public lighting as for ordinary consumers.

In further examination, witness said for his valuation the first figure he took was £1812, the profit for 1913. To the gas supplied by the Company to themselves at cost price, he added a proper margin of profit. In other words, he took it as a bulk supply, and gave a discount of 15 per cent., and a further 5 per cent. for cash. The total figure was £967; and deducting the sum actually received, £387 was the amount which should be added to the standard year. Then there was £57 on account of ammoniacal liquor. The total was £2257. As to deductions, the first was in the matter of repairs. He put down 1·51d. per 1000 cubic feet, or £156. A Company like this had a great advantage in the matter of both material and labour. The works were in quite good order, and thoroughly well able to earn the profit, year in and year out. In his opinion, 3½d. per 1000 cubic feet was sufficient to maintain the undertaking in a condition to continue earning the profit. He had added £20 for depreciation of stoves, and £6 for superannuation. Therefore he deducted £182 from the £2257, giving a maintainable profit of £2075, or exactly 20d. per 1000 cubic feet of gas sold. There were plenty of cases in which this profit was earned, and not considered at all abnormal; and he did not consider it was abnormal here. For the multiplier he had taken the 4½ per cent. table, which gave 22¼ years' purchase. With 5 per cent. for compulsory purchase, his figure came to £48,477. For the excess plant, he put down £2095; and the £180, at ten years' purchase, for severance, made £1800. This question of compensation for salaries was an adaptation of quite ordinary principles to this particular case. Allowing for capital expenditure and the value of the land, his final valuation came out at £52,707. He did not make any allowances for the small deficiencies on the works, because they were all discounted in the accounts. If the deficiencies were made up, the profits would be much larger, and they would be asking a considerably larger additional sum than the capital required for making up these deficiencies. The works as they stood were equal to maintaining the income.

In cross-examination, witness said that so far as he could see the works were quite decently managed. In arriving at a fair amount to charge for a bulk supply, he never calculated what the cost of the gas was to him. There were a great many things to take into consideration besides just the cost; and if one only reckoned the cost which was saved to the undertaking, it would not be worth while people taking a bulk supply and finding the capital. His total allowance for repairs and maintenance was 3·7d. per 1000 cubic feet; but he doubted if he could split up the items. It was an abnormally small amount, because of the abnormal undertaking; and therefore he could not split it up. He would think 1d. was rather high to put on the mains; but he would not dispute it. As to whether the mains were small, the pressures were ample; and as the pressure at the works was not excessive, it showed that the mains were sufficient for the profit. Perhaps one-quarter of them might have to be replaced when the consumption had doubled; but for the present there was no reason at all for them being enlarged. The difference between his valuation for excess plant and Mr. Woodall's, was that he had taken a proportion of the coal storage, and Mr. Woodall had not. He had not made any calculation of what the rateable value of an undertaking earning this profit ought to be; but he had compared it, and found the amount per 1000 cubic feet of gas was quite as much as others, and more.

Mr. TYLDESLEY JONES: You have not attempted to make a valuation of the undertaking for the supply of gas to the public as apart from the manufacture and supply of gas to the Company's own premises, or of the works necessary to give the supply?

Witness: Certainly not.

Could you assist me at all to value the public supply only?—You mean and leave us with our own supply—buying a portion of the undertaking?

Yes?—You cannot do that, because you have to buy the whole undertaking under the agreement.

That is a question upon which I am not going to ask an engineer to express an opinion?—No; the agreement speaks for itself.

Mr. HONORATUS LLOYD (in re-examination): We know the history of this undertaking. It was originally an undertaking to supply ourselves; and at the request of the public we supplied them in addition. Now it is suggested that we should sell the addition and keep the undertaking?

Witness: Yes; and have works much larger than we want, and therefore have to supply ourselves at an enormously enhanced price.

Do I understand you to say, in your experience, with companies such as this, the amount we paid in respect of rates is by no means unreasonable?—No. It is not unusual either.

LOCAL EVIDENCE.

Mr. *H. P. Beckett*, an architect and estate agent of Ellesmere Port, valued the sites of the gasholders and works at £169 2s. 6d.

Witness was cross-examined at considerable length as to the prices at which other pieces of land in the neighbourhood had been disposed of.

Mr. *Levy Lindop* a mechanic employed in the Shropshire Union Company's engineering department, stated that he had acted as superintendent over the foreman and the leading hands now in the gas-works. The foreman, William Nicholas, had now gone to another gas-works. It was not true that the whole of the foreman's time, or anything like the bulk of his time, was occupied in the gas-works. The head stoker's time was given up to the gas-works; but otherwise all the supervision was exercised by the representatives of the Company in among their other business. The mains were laid at a depth of 2 ft. 6 in. In recent times there had been several breakages, which he put down to the heavy traffic—steam-waggons and trailers. He had never known any canvassing for customers to be done. Gas had simply been given to anybody who asked for it. For the public lighting, the Company were supposed to supply gas to lamps which consumed 4½ cubic feet an hour. As a matter of fact, tests which had been taken by Nicholas showed that they were burning considerably more than this—in one case 5·7 feet per hour.

Fourth Day.

Mr. *Lindop*, in cross-examination, said he was responsible for the gas undertaking, and gave perhaps one-tenth of his time to it. His salary was £250 per annum. Nicholas at the time he left was in receipt of £138 per annum. Superintending mains and repairs was included in the one-tenth of witness's time. Nicholas would spend about an hour a day at the gas-works. The only men who devoted the whole of their time to the gas-works were six stokers. There was, of course, some clerical work involved. He was a member of the District Council, who had got an Electric Lighting Order. On one or two occasions they had been troubled with deposition of naphthalene in the station-meter. Special castings for the works were made in the Company's foundry.

Mr. *William Whittam*, Manager of the Shropshire Union Company, examined by Mr. HONORATUS LLOYD, stated that in 1912 there was a public meeting, and a request was made to the Company to lower the price of gas, and the following year the price was reduced. He had had no complaints with reference to the undertaking. Had the business been pushed, they could have shown a very different result. The Company could not re-invest any money they were awarded in similar gas-works. In fact, he could not see his way to investing the money so as to return more than 4½ per cent.

Cross-examined: The Company had loans of their own to get rid of, before they thought of investing any money they might get in War Loan.

Mr. TYLDESLEY JONES: Have you personally made any apportionments of time to the gas-works?

Witness: No; they have been made under my direction. I know the work that has to be done, and it is spread over so many. It is difficult to apportion; but it has been done, I believe, reasonably.

I am not suggesting that you have not done your best; but it is difficult to apportion. It has only been done for the purposes of this arbitration, quite *bonâ fide?*—Yes; we have not the slightest need to keep records of how much time it took a clerk to receipt a bill for 15s., or anything of that kind.

The ARBITRATOR: Have you formed any opinion in your own mind as to what would be done by the Company with the site which will shortly be vacated and put on their hands?

Witness: No; there has been no decision arrived at in any way, nor any proposals or suggestions made. It is obvious from the position of the land, without any access, that it can be used for very little. Nothing whatever can be done with it without the expenditure of a very large sum of money.

Mr. *Cash* was recalled to give the results of a close inquiry into the question of the officials whose services will be set free from the gas-works when the transfer takes place. He said from this it looked as though, if the men stopped on, the ten years' capitalization was well within the mark. The finding of fresh employment for the officials would be a gradual process.

This concluded the Company's case, except for the apportionment of an amount for capital expenditure from 1913 to April 30 last.

◆

Use More Gas and Less Coal.—In their issue of last Thursday, the "Daily Chronicle" remarked that mistresses who are burning gas instead of coal find that patriotism in this direction certainly pays when the problem of getting servants arises. On the previous day, they were informed by an official of a gas company that already hundreds of orders had been received for gas-fires as a result of the appeal recently appearing in the newspapers.

Cleveland Water Company.—The Cleveland Water Company's half-yearly report shows that, after meeting the expenditure, there remained a balance on the last six months' working of £5033. The Directors recommend that £3400 be employed in the payment of dividends at the rate of 10 per cent. per annum on the original and "A" shares, and at the rate of 7 per cent. per annum on the "B" shares, and that £1633 shall be carried forward to next half year's account. The Directors regret to report the death of Mr. W. I'Anson, who had been Engineer and Secretary since the beginning of the Company 46 years ago. They announce the appointment of Mr. William M. I'Anson, the Assistant Engineer for 22 years, as Engineer, and of Mr. W. J. Deighton, for 40 years in the service of the Company, as Secretary.

Wages Dispute at Stourbridge.—It was reported at a meeting of the Stourbridge Town Council last Wednesday that a number of employees at the gas-works had threatened to strike. On the 10th inst. letters were received from Mr. J. C. Mason (Secretary of the Amalgamated Society of Gas, Municipal, and General Workers) enclosing notices from the men to terminate their employment at the expiration of 21 days from Jan. 6; the reason presumably being that the advances in wages recently granted by the Council were not considered satisfactory. It was decided that Mr. Mason be informed that his demands would not be conceded; that each man be allowed to withdraw his notice up to mid-day last Friday, after which time his place will be filled; and that the Manager be instructed to take such steps as may be necessary to fill permanently the places of any men who leave.

GAS AND ELECTRICITY SUPPLY TO A SHELL FACTORY.

The Newport (Mon.) Gas Company and the Corporation Electricity Department.

The Newport Gas Company and the Corporation Electricity Department have recently been before the Board of Trade in connection with a proposal to supply with electricity a national shell factory situated outside the borough boundary of Newport, and outside the limits of supply of the Electricity Department. It appears that there is no need whatever for the supply of electrical energy for power to these works, as there is already installed there a supply of gas; and the trunk main leading to the entrance of the works is 12 inches in diameter. The Gas Company were never even asked to tender for the supply of the works, though the Company are already supplying gas to a large shell factory in Newport, both for lighting the premises throughout and for the lacquering of shells.

An agreement was made between the Committee of Management and the Electricity Department of the Corporation of Newport, for the supply of electric current to the factory. The Secretary to the Committee of Management is the Chairman of the Corporation Electricity Department. No information was afforded to the public with respect to this agreement until it was brought up for approval at a private meeting of the Council on Dec. 23 last; and on Dec. 24 the necessary plant was ordered. The Gas Company at once took steps to bring the matter before the Board of Trade.

The Board decided to hear the Gas Company in opposition to the application of the Corporation for permission to lay a cable beyond the borough boundary to the works. The inquiry lasted a considerable time; evidence being given on the side of the Corporation by Mr. J. Moxon (Chairman of the Committee), also by a member of the Committee of Management, and by Mr. Nichols Moore, the Corporation Electrical Engineer. The Gas Company were represented by their Solicitor, Mr. Wilson, of the firm of Messrs. Davis, Lloyd, and Wilson, of Newport. The evidence on the side of the Gas Company was given for the most part by their Engineer (Mr. Thomas Canning); but there were also present at the inquiry, ready to give evidence if required, the Secretary of the Company (Mr. T. H. Hazell), the Deputy-Chairman (Mr. Cartwright), and some members of the Board. There were also present Mr. Goodenough and Mr. Mason, on behalf of the British Commercial Gas Association; and their advice and assistance were of great advantage.

The Board of Trade finally consented to grant the Order to the Corporation, limiting it to the shell factory; and it is only to remain in force for such time as the premises shall be used by the Government as a shell factory. This is a very important qualification, which perfectly justifies the Gas Company having made their appeal to the Board of Trade.

USE OF GAS IN WAR TIME.

The Good Work of Apparatus Makers.

At the Annual General Meeting of the Midland Association of Local Government Officers, held last Wednesday at the Exchange Hotel, Birmingham—the President, Mr. H. E. Stilgoe, City Engineer and Surveyor, in the chair—a lecture entitled "Gas Aid in War Time" was delivered by Mr. R. J. ROGERS, Assistant Fittings Superintendent to the Birmingham Corporation Gas Department. The meeting was well attended. A similar lecture was delivered by Mr. Rogers on Friday, at the Smethwick Technical School.

In the course of his lecture, Mr. Rogers stated that there were very few industries in this country that had not been affected in some degree by the war; and though in many directions there had been delays—some inevitable and some otherwise—it had been truly remarkable to see the ready manner in which certain industries had responded to the new order of things, and reorganized their business to meet the changed conditions. The gas industry, in common with others, had had great responsibilities placed upon it, not only in supplying gas for industrial purposes in munition factories, but in providing the essential products for the manufacture of high explosives. It had doubtless come as a surprise to many people to hear that extractions from coal gas played such an important part as raw material in the production of high explosives.

A large amount of notice had been attracted to the articles in the daily Press during the last few days, as to the extended use of gas for all purposes, which had been advocated by the Ministry of Munitions, in order that the supply of toluol and benzol should not be restricted. It was of the utmost importance that gas should be used to the greatest manufacturing capacity of the various gas-works in the country. The output of gas by different gas undertakings varied largely according to the geographical position of the undertaking. While the consumption in some areas had been low during the war, the demands on other gas-works—particularly those in munition areas—had been very great and embarrassing. Birmingham was not the only gas undertaking which had been compelled to ask consumers to economize in their use of gas for domestic purposes. The demands in Birmingham for gas for use in munition factories had been so great that it was necessary that for the moment the strictest economy should be exercised.

He referred to the recent report issued by the Special Committee appointed by the Ministry of Munitions, on "industrial canteens," and said it was gratifying to know that in most of the large munition works in Birmingham arrangements had been made for providing work-peoples' dining-rooms; and in this direction gas-heated appliances for warming dinners, cooking food, providing hot water for teas, &c., had been installed on a large scale. By means of lantern slides, the lecturer fully explained how gas was helping in the manufacture of

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munitions, from service cartridges to 15-inch shells, in the manufacture of transport motors, in the equipment of the army, the making of boots, caps, and clothing, in cooking for men in barracks, and for providing the cooking and heating arrangements in hospitals, operating theatres, &c.

In conclusion, Mr. Rogers stated that due credit should be given to the large gas apparatus manufacturers in the country for the way in which they had dealt with the extraordinary needs of the munition makers. To a great extent, munition manufacturers were indebted to the speedy manner in which the apparatus makers designed the necessary furnaces for dealing with the manufacture of shells. A good deal of experimental work had been necessary before the apparatus could be constructed; and the fact that they had been able to "deliver the goods" in such a short time bore testimony to the excellent organization of the makers of gas-heated furnaces in this country.

KENSINGTON BOROUGH COUNCIL AND GAS-TESTING.

The Works Committee of the Kensington Borough Council have again had under consideration the letter received from the Ministry of Munitions on the subject of the notice given by them to the Gas Light and Coke Company requiring the extraction of certain constituents from the Company's gas which may somewhat affect the illuminating and calorific standard imposed by law, together with the terms of the report which they submitted at a previous meeting of the Council, and which was withdrawn after some little discussion.

The Committee now report that they feel it to be only due to themselves to point out that, in the earlier report, no exception whatever was taken to the requirements which the Ministry of Munitions had made upon the Gas Light and Coke Company. Continuing, the Committee say: "Nothing could be further from our wish than that any obstacle or difficulty should be raised to the Government obtaining from the Company any of the bye-products of their gas which might be of service in the prosecution of the war. What we thought the Council should dissent from were the suggestions put forward in the letter from the Ministry that the testing of the gas supplied by the Company should cease, or that if the tests were continued the results of the tests should not be allowed to be made known to the public; and we still adhere to the view that no good purpose is likely to be served by these suggestions being acted upon, and that the public are entitled to know the quality of the gas with which they are being supplied, even if the standard of that quality may be lowered. The Company can in a very great measure, by a process of artificial enrichment, make good any loss of illuminating and calorific power occasioned by the withdrawal from their gas of the constituents which the Government are requiring; and we fail to see that any cause is shown for depriving the gas consumers in the Metropolis of their safeguards as regards the quality of gas supplied to them, or for removing all checks or control upon the Gas Company. We recommend (*a*) that a communication be addressed to the London County Council intimating that this Council are in no way desirous of hampering the Gas Light and Coke Company in any action which they may be taking for the assistance of the Government, but they are not able to agree with the suggestions which have been put forward in favour of the cessation of the testing of the gas or the non-publication of the results; and (*b*) that, in the event of the above recommendation being adopted, the views of the Council on the matter be communicated to other Metropolitan Borough Councils for their information."

JOINT-STOCK COMPANIES' RETURN.

The Twenty-Fourth Annual Report by the Board of Trade on matters within the Companies Acts, 1908 and 1913, contains the usual list of companies dissolved or struck off the register during the period dealt with—the year ended Dec. 31, 1914. This includes the following companies, some of which, of course, may have since been re-incorporated, under the same or a similar name.

Aberford Gas Company, Bedlington Gaslight Company, Bishop's Castle Gaslight and Coke Company, Bishop's Waltham Water-Works Company, Blakeney Gaslight and Coke Company, Boughton Blean Gas and Coke Company, Bridge of Earn Gaslight Company, Cavan Gaslight Company, Chinley Gas Company, Condal Water Company, Donaghadee Gaslight Company, Great Coggeshall Gas Company, Kingswood Water Company, Kirriemuir Gas Company, Lanark Gas Consumers' Company, Lisburn Gas Company, Narberth Gas, Coke, and Coal Company, North Oxfordshire Water Company, Penkridge Gas Company, Robertsbridge, Salehurst, and Hurst Green Water and Gas Company, Stanford-le-Hope Gas Company, Theale Gas Company.

Daylight Incandescent Mantle Company, Foreign and Colonial Lighting Company, Gas, Water, Finance, and Contract Company, Golden Gleam Mantle Syndicate, Heat, Light, and Power Syndicate, London Gas-Mantle Manufacturers, M.H. (Methane Hydrogen) Gas Plant, Matchless Self-Lighting Mantle Syndicate, Merlin Gas and Engineering Company, Morton Gas Syndicate, New Sunbeam Acetylene Gas Company, Non-Explosive Gas Company, Notkin Light and Power Company, Petrolite, Limited, Platico Mantle Company, Robin Gas-Mantle Works, Star Incandescent Light Company, Tourtel Gas and General Engineering Company, Universal Water-Meter Company, Westminster Gas Compressors.

District Electric Company, Electric Ignition Company, Electricity Generating Company, Electric Power Plants, Harrington Electric Light Company, Leicestershire and Warwickshire Electric Power Syndicate, Madeira Electric Lighting Company, Mutual Electricity Company, Preston Electric Company, Provincial Electrical Company.

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Good Stocks available.

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THE JARROW RAILWAY ACCIDENT.

Gas Lighting in Trains.

The Board of Trade inquiry in connection with the fatal railway accident which occurred near Jarrow on Dec. 17, was resumed and concluded by Colonel Von Donop at Newcastle last Thursday. The earlier proceedings were referred to in the issue of the "JOURNAL" for Dec. 28, p. 720.

One of the drivers, who gave evidence at the previous hearing, was recalled, and in answer to the Inspector said the first outbreak of fire he saw was from a gas-jet.

The Acting Chief Engineer of the Railway Company (Mr. A. C. Stamer) stated that the pressure in the gas-cylinders of the two leading vehicles of the up passenger train was about 75 lbs. per square inch. In the leading coach of the empty train, the pressure would be about 20 or 25 lbs. per square inch. The Company had gone into the question of strengthening the ends of the cylinders, and whether cylinders could be housed more safely. They had gone further, and had built a dining-car, and housed the cylinders well up in the frame, and reduced the diameter of them. The question of using non-inflammable wood in the construction of the carriages was considered; but owing to the war, there was not time to go further into the matter, which would involve a good deal of expense. At the same time, they experimented with some all-steel carriages. The electrical stock running on Tyneside had had non-inflammable floors from the commencement. The Company had fitted 344 coaches with electric light, exclusive of those on Tyneside. During the last three years, all passenger-carrying vehicles built by them had been fitted with electric light. The vehicles to be built this year would also be so fitted. The figures he had given related purely to North-Eastern Railway stock, and did not include the vehicles of the East Coast joint service. A large majority of the latter were also fitted with electric light, and the same applied to the North-Eastern and Great Northern joint stock.

SCOTTISH FARMERS AND SULPHATE OF AMMONIA.

A Deputation in London.

Reference was made in "Notes from Scotland" last week to the difficulty which Scottish farmers are stated to be experiencing in securing supplies of fertilizers on terms that commend themselves to the users. The matter formed the subject of a deputation of agriculturists to the Scottish Office, in Whitehall, on Thursday. The delegates asked that immediate relief should be afforded in the matter of railway transit, and that there should be made available the full home output of sulphate of ammonia for fertilizing purposes. This, it was urged, had become necessary owing to the impossibility of securing supplies of nitrogenous fertilizers from South America.

Mr. F. D. ACLAND (Parliamentary Secretary to the Board of Agriculture), in his reply, said the Board had tried to popularize the use of sulphate of ammonia; and they had asked the makers to reduce the price on the understanding that the Board, in cases where it would pay, would induce farmers to use sulphate. It was not, however, easy to go to the producers and ask them to reduce prices for the ordinary spring trade. The Government could secure supplies; but they could not anything like so easily fix prices. Whether the suspension of licences for export would have any effect on prices might be open to consideration. Even if the issue of licences was suspended for some time, it could not be suspended altogether. He asked Scottish farmers, where possible, to take advantage of buying the sulphate without waiting for the price to come down. As to nitrate of soda, it was known that the Government had bought a considerable quantity in order to ensure ample supplies. Since the purchase, freights had got quite extraordinarily worse. It might still be possible to get nitrates over in time for this season; but he advised farmers not to make any arrangements on this basis. He saw no prospect of the freight difficulty getting better—on the contrary, he thought it was going to get worse. There was a good deal of nitrate of soda in the country; and the demand for munition purposes was considerable. For such purposes, higher prices were offered than the farmers would care to give.

Mr. M'KINNON WOOD (Secretary for Scotland) pointed out that it was inevitable that transport facilities should be inadequate for all needs in time of war. He would suggest that, where difficulties were acute, the Department should be informed; and then, in association with the railway companies, powers would be secured so as to meet deficiencies.

HOBART ELECTRICITY SUPPLY.

The Gas Company's Undertaking.

A Select Committee has been inquiring into a Bill having for its object the carrying into effect of an agreement between the Directors and the Minister of Lands and Works for Tasmania for the acquisition of the electrical undertaking of the Hobart Gas Company; and a report by them has been presented to the House of Assembly.

The Committee, in the course of their report, state that evidence was procured from independent experts and all parties interested in the measure, who dealt with the questions involved from their various aspects. While giving every attention to what was submitted, the Committee paid particular attention to the financial side—the price which the State are asked to pay the Hobart Gas Company for their electrical undertaking, the reasonableness or otherwise of this price, the amount of revenue likely to accrue to the State as a result of the contemplated

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purchase, and also the legal position of the State as between the Hobart Town Gas Company, the State itself, and the right reserved to the Hobart Corporation under an Act to authorize the Hobart Town Gas Company to light the City of Hobart and the suburbs by electricity, which was passed in 1895.

The conclusions arrived at by them are: (1) That if the Bill is not passed, there will be three authorities in Hobart with the right to supply electric power—namely, the Hobart Corporation, the Hobart Town Gas Company, and the State—thus causing confusion and complication. (2) That under ordinary circumstances the lighting of the City of Hobart should be undertaken by the Corporation; but as the State Hydro-Electric Department may have to depend upon the consumption of electricity in Hobart and suburbs for its revenue for the first few years of its operations, there is little chance of the department materially expanding those operations under the present system of triple supply. There is, however, scope for considerable expansion of business in Hobart if the State becomes the sole supplier. The undertaking, as provided for in the Bill, is, the Committee believe, a sound financial proposition for the State. (3) That it is in the best interests of the State that the Bill should pass, with slight amendments.

The Committee direct attention to section 35 of the Hobart Town Gas Company's Electric Lighting Act, which provides that all profits made by the Company over 12 per cent. per annum shall be divided between the Company and the Corporation of Hobart, and recommend an amendment of the Bill, to protect the rights conferred upon the Corporation of Hobart by the Act. The Committee further recommend that a clause be inserted in the Bill to remove any doubts as to the power of the Hobart Town Gas Company to distribute money, &c., received in connection with the sale of their electric light property to the State, as provided for by the Bill.

The report was received; and it was ordered that the Bill be taken into consideration.

The official transfer to the Government of the Gas Company's electrical plant took place on Dec. 7.

South Metropolitan Gas Bill.—The General Purposes Committee of the Lambeth Borough Council have reported that they have examined the South Metropolitan Gas Bill, from which it appeared that the provisions of the Bill were all financial. They did not seem to affect the Council in any way, save that it was not expressly stated that the new stock which the Bill was to empower the Company to issue was to be, as regards dividends, on a sliding-scale, varying with the price of gas. The stock would probably be held to be entitled to dividends only in accordance with such scale; but in order that the point might be placed beyond doubt, the Town Clerk had communicated with the Company's Parliamentary Agents, with a view to some provision to this end being inserted in the Bill. This course they were willing to adopt. The Council approved the action taken by the Committee.

NOTES FROM SCOTLAND.

Lighting of Edinburgh Streets.—On Friday last, the Lord Provost of Edinburgh, the Commander of the Coast Defences, and the Conveners of the Electric Lighting and Cleaning and Lighting Committees, with the officials, met to consider the question of the public lighting of the city. It was decided, on the advice of the military authorities, to continue the present regulations. This means that practically the whole of the gas-lamps will remain unlit—the reason being that, in the event of an air-raid, some hours would be occupied in extinguishing the lamps if they were in use.

New Edinburgh Electric Power Station.—The question of the new electric station to be erected at Portobello (a suburb of Edinburgh) came before the Edinburgh Town Council last Tuesday. The cost of the works, for which tenders had been accepted, was £93,369; and the estimated cost of the remainder of the work was £106,215—a total of £199,584. A report from the Electric Lighting Committee recommended general approval of the plans and elevation of the station, and asked for a remit to obtain and submit estimates for carrying out the work. The report and recommendation were approved. The Edinburgh electric undertaking has made great strides in recent years, and, with energy at 2⅞d. per unit for lighting and 1⅛d. for power, is a serious competitor, in both fields, with the Gas Commissioners.

A Schoolboy Electrocuted.—A schoolboy named Walter Jamieson, of Nitshill, Renfrewshire, met with instantaneous death last week, through accidentally touching a live electric wire. He was on his way to school when he met with the accident, which arose through the wire having fallen to the ground.

Aberdeen Water Officials to Refund Gratuities.—In connection with the Aberdeen Water Bill, which is now before Parliament, a large amount of extra work has devolved upon the Water Engineer and others. The Provisional Order Sub-Committee, feeling that some recompense was due, granted gratuities of £300 to the Engineer, £150 to his Assistant, and smaller sums to other officials—in all, £513. At a meeting of the Town Council on the 17th inst., the power of the Committee to make such grants was questioned; and, after a lengthy debate, it was agreed, by 26 votes to 6, to disapprove of this action, and to request the officials to refund the sums paid to them.

Electrical Breakdown at Wigan.—There was a failure of the Wigan Corporation electricity supply last Friday evening, just at the time when trade was at its highest, and when the houses of entertainment were in full swing. There had been much uncertainty about the supply all day; and the tramway service was suspended. It seems that the steam-raising capacity of the plant at the generating station is sufficient; the contractors being unable, owing to the war, to deliver new boilers which it was anticipated would have been supplied and in use by last Christmas.

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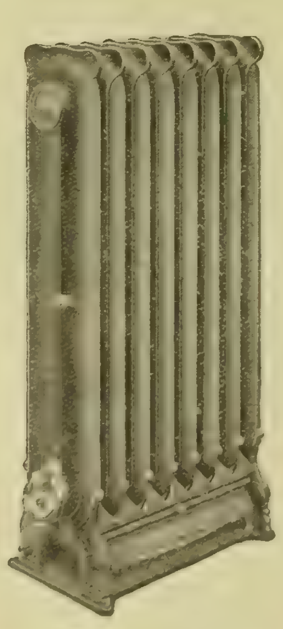

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 24.

Tar products are generally unchanged in price. Pitch, which is still quoted at 19s. to 19s. 6d. net, is, of course, largely governed by the freight situation, and it appears likely that freights have been carried too high recently, and that a recoil may be anticipated. Solvent naphthas are in large demand; while naphthalene in any form is almost unobtainable. Creosote remains at 4⅛d. to 4¼d. net in bulk at makers' works.

Sulphate of ammonia is firm at £17 5s. net per ton, filled into buyers' bags at makers' works for 25 per cent. quality for January-June delivery.

Tar Products in the Provinces.

Jan. 24.

The markets for tar products remain about the same. One or two sales are reported in pitch, but not of much importance. After making allowances for the freight, the price works out at the equivalent of to-day's quotations. Creosote continues quiet, and is still being offered in large quantities. Heavy and solvent naphthas are in very good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. 1d. to 2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Jan.* 22.

Owing to the unsettled conditions prevailing in this trade, the market has been inactive throughout the week, and prices have receded a little below the highest points recently attained. The nearest values at the close are £17 13s. 9d. per ton f.o.b. Hull, £17 17s. 6d. f.o.b. Liverpool, and £18 1s. 3d. f.o.b. Leith for delivery this or next month. No transactions have been reported in the forward position, and it is evident that buyers and sellers have both made up their minds to await developments before committing themselves further.

Nitrate of Soda.

The spot prices of this material have advanced further, and the quotations are now 16s. 6d. per cwt. for ordinary quality, and 17s. 6d. for refined.

Sulphate of Ammonia.

From another source, it is stated that there is nothing fresh to report concerning this article, and prices are practically the same. Outside London, makes are £17; Hull, £17 15s.; Liverpool, £17 17s. 6d.; Leith, £17 17s. 6d. to £18; Middlesbrough, £17 15s. to £17 17s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is brisk, though new regulations as to the licences for coal export are affecting some classes of fuel. In the steam coal trade, the Government appear to be taking a larger proportion of the output; and this is stiffening the market. With, therefore, limited quantities of steam coals available for a fortnight or so, the prices are naturally very firm. Best Northumbrian steams are 25s. per ton, though higher prices are sometimes asked for next month; second-class steams are somewhere near 23s.; steam smalls vary from 12s. 6d. to 15s. per ton—all f.o.b. In the gas coal trade, the demand is good, though it is now past the most pressing consumption period. Best Durham gas coal is about 22s. 6d. per ton f.o.b., second-class gas coals are near 21s. per ton; and "Wear Specials" are steady at 21s. 6d. per ton f.o.b. There is still some scarcity of gas coal for prompt delivery. Rates of freight continue high—gas coal from the Tyne to London being nominally about 15s., but much coal is being carried on freight-contracts at differing rates. The Durham miners' annual report (just issued) states that 30,000 of the members have enlisted, so that the effect on the coal production of the county is readily seen to be very great, and accounts for the relative scarcity of gas coal during the current month. Nothing is doing in contracts for gas coal just at the present time. Gas coke is steady generally, and may be quoted as 28s. 6d. to 29s. 6d. per ton f.o.b. Stocks are fairly heavy at some of the inland gas-works.

* * *

The Reason for Economy in Birmingham.—The general appeal published requesting householders to assist in the production of high explosives by burning more gas and less coal, has, says the "Birmingham Post," caused some confusion in Birmingham, where the public have repeatedly been asked to economize in the consumption of gas. In an interview, an official of the Corporation Gas Department stated that while, generally speaking, the appeal was well founded, Birmingham was peculiarly situated, owing to the tremendous demand for munition factories. The Gas Department were not anxious to encourage the use of gas for domestic purposes at present.

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Nottingham and Gas-Fires.

The opening by the Nottingham Corporation of new gas showrooms, in a central part of the city, for the display of up-to-date cooking and heating apparatus, has been quickly followed by a spirited newspaper correspondence locally anent the relative merits of gas and coal fires. Already, therefore, the venture may be said to have more than justified its inception, and that in a manner which could not have been contemplated specially under the original scheme of operations. A writer responsible for a column of daily newspaper "Notes by the Way" had had the temerity to suggest that "there is no gas-fire on the market as yet that will compete with the open fire in either health or comfort." But he has been subjected to some drastic criticism by a correspondent who declares emphatically in favour of gas as being healthier and far more of a comfort than the old open fire—healthier because there is no dust, and more convenient from the fact (especially important in cases of sickness) that a room can be kept at an equable temperature—an impossibility almost with a coal-fire. Manifesting practical acquaintance with the subject, the correspondent also serves a useful purpose by pointing out that the gas-fire selected should be properly fixed with a cone over the exit pipe in the chimney to stop the down-draught sending fumes into the room.

Accident to a Gas Manager.—While engaged repairing a cylinder at the Carrickmacross Gas and Electric Works, the Manager (Mr. Wm. Scotson) sustained severe injuries to the face by an explosion of gas in the cylinder.

Progress at Burslem.—At a meeting of the Burslem Municipal Association last Tuesday, Alderman T. Mitchell (the Chairman of the Stoke-on-Trent Gas Committee) read an instructive paper showing the progress of the Burslem gas undertaking since the year 1876, when it was taken over by the Local Board from the Burslem and Tunstall Gas Company at a purchase price of £80,000. The total length of mains in the area now exceeds 45 miles, and there are 8283 meters in use, of which 6227 are automatic. The total capital value had been increased to £131,416; there is a loan indebtedness of £64,068; and up to the time of federation the works had contributed £66,600 to the relief of the rates.

Holmfirth Gas Company.—The annual meeting of the Company is to be held to-morrow, when accounts will be submitted which show a profit on the year's working of £1553. The gas made, under Mr. A. E. Buckley (the Manager and Secretary), was 37,342,800 cubic feet, or an increase of 3,165,800 cubic feet over the twelve months ended Dec. 31, 1914. The increase in the make equalled 9·26 per cent., and in the quantity sold 10·2 per cent. The gas made per ton of coal carbonized was 11,385 cubic feet; and the percentage unaccounted for, 5·02. The increase in the make per ton over the preceding year (which coincides with the installing of a retort-house governor) is 385 cubic feet, which represents a saving of 115 tons of coal.

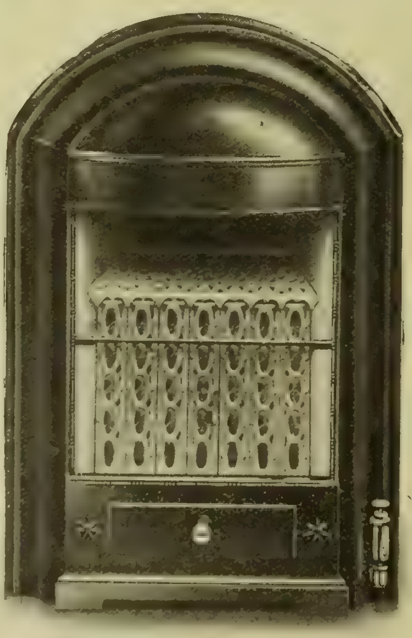
Gas Undertakings and Road Board Funds.

The "Yorkshire Observer" states that a gas engineer who occupies an advisory position in one of the Government Departments dealing with war matters writes: "Though the gas concerns, as recently announced in the Press, are generally patriotically doing their duty at a financial loss by extracting from the gas benzol and toluol, which are converted into high explosives for the defence of the country, yet there is another aspect of the situation which would materially aid them and have the effect of reducing the price of gas. The Road Board, before the war, with the funds allocated to them by the Government, kept the main roads in excellent repair. In a recent announcement in print, it appears that the usual funds at their disposal have been diverted elsewhere. Considering the bad state of repair the roads throughout the kingdom have now got into, I consider it to be very false economy that these funds have been diverted, because roadways, especially main roadways, during war time may be considered, in these days of rapid road transit, as of equal importance with railways, especially in view of the congestion on the railways for the carriage of goods and passengers. Now, to a large extent the gas concerns were the means of supplying the specially prepared tar used for the roads to keep them in a fit state of repair. This market is to a very large extent closed to the gas concerns, even though they have been induced to put up special apparatus in many cases to form the prepared tar. In the preparation of this tar the valuable constituents required for high explosives are separated and converted into explosives. The consequence is that tar now has to find its way to established distilleries, and further helps the congestion of railway traffic. Large accumulations of pitch and tar are lying at the distilleries. The general result is that the price of tar has decreased to such an extent as to impose a further loss on gas concerns. This is bound to reflect itself in the prices of gas. It cannot be said that the labour to carry out this form of repair to the roads is wanting; for it may be noted that there are plenty of men of non-military age engaged upon trimming hedges, paths, &c. They would be more usefully employed repairing the roadway itself. The Government, in the interests of true economy, should reconsider the matter."

Gas Profit at Tow Law.—At the last meeting of the Tow Law (Durham) Urban Council, the District Auditor's report was presented, showing a net profit on the gas-works during the last financial year of £290, after the Council had incurred an expenditure of £201 on new plant, &c.

Lighting of Pontardulais.—A parish meeting of the Hendy lighting area has approved of the action of the Joint Lighting Committees of Llandilo Talybont and Llanelly in terminating their contracts with the Gas Company on account of the action of the latter in raising the price by 6d. per 1000 cubic feet. The Joint Committee are also asked to take further drastic steps.

By Appointment.



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You can't make these Fires light back.

The heat is intense—perfectly distributed —and no apparent flame.

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Liverpool Public Lighting.—A meeting of the Liverpool City Council took place last Wedensday, to see whether any further reduction could be effected in the estimates of the various committees. The members were not successful in cutting down any of the items; but, on the other hand, a proposal to add £700 to the street lighting estimate, in order to provide for an advance of 2d. per 1000 cubic feet in the price of gas, was adopted by a large majority.

Blackburn Gas-Works Fire.—Last Tuesday, a fire broke out in the purifying-house of the Greenbank Gas-Works of the Blackburn Corporation. It was stated that, owing to spontaneous combustion, the contents of four carbon dioxide boxes had burst into flames. On the arrival of the local Fire Brigade they devoted their attention to isolating the four boxes from the others, and so prevented damage to the building, which is not connected with other parts of the works. The flames rose to a considerable height, and one or two slight explosions caused alarm. After about three hours' energetic work the firemen left, having successfully prevented damage to the building.

Early Appreciation of the Benefit of Gas.—The number of the "Times" for Jan. 22, 1816, contained the following intimation: We are glad to be able to inform our readers, that the proprietors of the gas manufactory have made the greatest exertions to abate whatever was offensive to their neighbours. The stench is almost totally removed by a contrivance which conveys the fetid liquor at once into the stream of the Thames, even at low water; and the smoke, besides being in a great measure consumed by the intensity of fires kept up to an excessive heat for the purpose, is made to pass through a tube of so great a height that, in the average state of weather, it rises a considerable degree above all the neighbouring houses, and even on the most unfavourable days is, from its rarity, too light to sink in atmospheric air. The inconvenience to the senses which still exists is so trifling that we hope that no person will put it in competition with what must universally be considered a public benefit.

Gas Affairs at Heywood.—At the last meeting of the Heywood Town Council the minutes of the Gas Committee were approved. These included the appointment of a Committee to report concerning alterations to the sulphate of ammonia plant as recommended by the Gas Engineer (Mr. W. Whatmough); an application by stokers for holidays with pay; and the adoption of a recommendation from the Master of the Mint urging the clearance of prepayment meters at more frequent intervals. At a special meeting of the Gas Committee a fortnight ago, it was resolved that four days' holiday with pay be granted for 1916 only, to stokers who may have been employed for not less than six months during the year ending May 31 next. The Chairman of the Gas Committee (Mr. David Healey) said the Committee had decided to clear the prepayment meters a little more often, and so give what assistance they could to the request of the Mint authorities. With regard to the holiday question, the men affected had not been working a full year, and they could only grant them four days' holiday instead of eight days.

Northallerton Water Loans.—Mr. R. Jameson informed members at the last meeting of the Northallerton Urban Council that the Local Government Board had intimated, in reply to the Council's application for an extension of the period for which the water loan had been made from 30 to 45 years, that they could not go beyond 30 years. However, Mr. Sandiman (the Chief Inspector of the Local Government Board) intended to use his influence towards obtaining the extension. The bankers had agreed to accept 4½ per cent., instead of the 5 per cent. they asked for; and this would mean a considerable saving.

"Pampered" Electricity at Dewsbury.—At the last meeting of the Dewsbury Town Council, Alderman J. M'Cann (the Chairman of the Gas Committee) moved an amendment to a recommendation for the purchase of a second-hand generating plant for an extension of the electricity undertaking, at a cost of £2925 for engine and housing. He said he was sorry to differ from the Electricity Committee, in whose doings he had taken a deep interest for 25 years; but the Government had definitely stated that expenditure of this description was not to be incurred. The Electricity Department had been pampered and given every encouragement, with results which were not satisfactory. While the capital outlay of over £69,000 had yielded only profits to the relief of rates of £4250 in the last ten years, the Gas Department, with a capital cost of £232,800, had provided over £69,000 for the rates in the same period. It was no use developing an undertaking which would be absolutely "flattened" if put into competition with the Yorkshire Electric Power Company, with whom arrangements could be made for any additional supply required by the department's consumers. The amendment was defeated, and the recommendation adopted.

Manchester Coroner's Jury and Naked Gas-Jets.—A Manchester Coroner's Jury recently investigated the cause of an explosion which took place at a rubber proofing works in the city, by which a workman lost his life and another received severe injuries. The explosion occurred in the room in which there were two machines for mixing rubber and naphtha. There were also a couple of tins in the room which contained about ten gallons of naphtha. Certain fumes arose from the rubber while undergoing treatment. A gas-engine was fixed in the room, which was illuminated by six gas-jets fitted with incandescent mantles, but no globes. A gas-jet was fixed just over one of the tins of naphtha, about a yard away. The Acting Coroner (Mr. C. W. W. Surridge), in his summing-up, said the probability was that the explosion was caused by the contact of the fumes and the gas. It seemed to him this was a case where the Jury might desire to recommend that electric lighting should be installed. A juryman, however, pointed out that, as this was the first mishap the firm had ever had, it was unfair to condemn incandescent gas lighting. The firm might, however, as an additional safeguard, have the lights enclosed in some way or other, to prevent anything falling into inflammable matter and causing an explosion. The Coroner said this would meet the case. The Jury returned a verdict of "accidental death," and recommended that naked lights should not be used in future—gas or electric.

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AND AT BIRMINGHAM, MANCHESTER, LEEDS, STOKE-ON-TRENT, HULL, BRISTOL, AND DUBLIN.
Welsbach Mantles are Upright (C, CX, and Plaissetty) and Inverted.

Proposed Gas-Works Improvements at Ripon.—A decision has been come to by the Ripon City Council to apply to the Local Government Board for sanction to borrow £9000 for the improvement of the gas-works; and they appointed as Consulting Engineer Mr. J. Wilfrid Dunn, of Stockton-on-Tees. At the next meeting, Mr. Spence is to move—" That a small Committee be appointed to inquire into the terms and conditions under which a supply of electric light may be provided for the city by delegation of the Corporation's electric lighting powers to a suitable public company, and, after investigation, to report."

Colchester Gas Bill.—The Lexden and Winstree Guardians have adopted a report by a Special Committee recommending that they be authorized to negotiate for the insertion of clauses in the Bill of the Colchester Gas Company for the protection of the parishes affected, and, if needful, to instruct the Clerk to lodge a petition against the Bill. The Chairman (Mr. W. Deason) remarked that, so far as they were concerned, the principal point about the Bill was that the Company proposed to charge 9d. per 1000 cubic feet more than in the borough of Colchester. He thought it was not right that they should have a monopoly of this sort without a time-limit. Among other things, the Committee felt they must have some protection in regard to the breaking-up of roads.

The East and West Ardsley Urban Council have been informed by the Morley Corporation that, in view of the increased cost of coal and labour, the price of gas supplied to Ardsley is to be increased from 2s. 9d. to 3s. 3d. per 1000 cubic feet.

Mr. Harry Mitchell, of Leighton Road, Kentish Town, turning his attention for a brief space from patent lock manufacture, has designed a "Safety" Treasury Note wallet. A trial of one he has forwarded, proves his contention that the notes cannot work loose and fall out.

The West Riding County Council have decided that, unless clauses or amendments in protection of the interests of the County Council and the inhabitants of the Riding, to the satisfaction of the West Riding Law and Parliamentary Committee, be inserted, the Council will oppose the Beighton and District Gas Bill, the Wakefield Corporation Water Bill, and the Yeadon Water Company's Bill.

The Brighouse Corporation Gas Committee have been asked by the local branch of the Gas Workers' Union (whose Secretary is Alderman R. Morley) for an advance in wages of gas stokers to 6s. per shift; that they should receive a full week's holiday in summer with pay, and have double pay on Good Friday; and that the yard men and all others be paid the standard rate of 7d. per hour.

STOCK MARKET REPORT.

The week just concluded on the Stock Exchange has been a good average one as times go nowadays, and business, though starting and closing quiet, quickened up to a considerable extent in between. Some markets, too, were conspicuously firm. Government issues were well supported. In mid-week the War Loan was a little prejudiced by a rumour of an approaching new loan; but this *canard* was promptly strangled, and the position was restored. Home Rails, which had been in great demand, reacted. In the Foreign Market, the French loan maintained its advance almost day by day, and now commands a nice premium. Japanese was a good second in the race; and Chinese also attracted some attention. Troubles still beset the American Market, and it had a very dull week. Encouraged by good harvest prospects, Argentines continued to rise; but the pressure was overdone, and a sharp reaction set in. In the Miscellaneous Market there were several strong corners. Rubber was, of course, by far the most conspicuous; the steady advance in the price of the material producing a big demand for shares. Oils, textiles, and various armaments also had a good time in varying degrees. So, taken all round, the general tendency was favourable—a contributing influence thereto being found in the successes of the Russian armies during the week. Among topics of interest, the dollar securities' mobilization is going on so well that the Treasury have extended their list of purchasable issues. But the House is rather sore at having, as they think, the wind taken out of their sails by the Government. The popularization of Exchequer Bonds by the issue of small denomination bonds is growing. The question of promoting this by a preferential lightening of the income-tax on bonds is being mooted. But the inculcation of thrift upon the people is being heavily handicapped by the amazing revelations of waste in Government departments, some of which appear, to be irrefutable. Unrest at the inequitable working of the minimum prices is again manifesting itself on the Stock Exchange. In the Gas Market, business was more active, and the tone was stronger. The announcement that the Gas Light and Coke Company will maintain their statutory dividend and will carry forward an increased balance was well received; and the ordinary stock rose 2¼ upon its opening price. Some other issues were strong. In the Money Market rates were materially harder.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 72½, 72⅞, 73, 73¼, ditto preference 76⅝, Oriental 99, 99½. On Tuesday, British debenture 52½, Gas Light ordinary 72⅝, 73, 73¼, 72⅜, 72½, ditto preference 76, Oriental 99, 99½, South Metropolitan 77, 78¼, ditto debenture 60½. On Wednesday, Bombay 4⅞, Commercial 4 per cent. 76½, Gas Light ordinary 72¾, 73⅜, Oriental 99⅛, 99½, San Paulo preference 8¼, South Metropolitan 77. On Thursday, Commercial 4 per cent. 75, Gas Light ordinary 73¼, 73¾, ditto maximum 60, 60½, ditto preference 75½, Newcastle 81, Primitiva 2¼, South Metropolitan 77⅝. On Friday, Bombay 4⅞, Bournemouth 25¾, 25⅞, Commercial 4 per cent. 75, Gas Light ordinary 73¾, 73⅞, 74, 74⅛, 74¼, Imperial Continental 70½, South Metropolitan 77, 77⅞. On Saturday, Commercial debenture 54, Gas Light ordinary 74¾, ditto preference 76⅝, Imperial Continental 70, 70¼, Primitiva preference 70s., 72s., South Metropolitan debenture 61¼.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	8 18 2	..
874,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	4⅞
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	25¾—25⅞
873,480	10	"	7	7/-	Bournemouth Gas and Water B 7 p.c.	15—15½	4 10 4	..
95,000	10	"	6	6/-	Bournemouth Gas and Water Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Bournemouth Gas and Water Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	†6/-	Brentford Consolidated	261—266	5 5 3	..
830,000	"	"	†11	55/-	Do. New	204—209	5 5 3	..
50,000	"	"	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	52½
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	75—76½
560,000	"	"	5⅓	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	54
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	72½—74¾
2,600,000	"	"	3½	3½	Gas Light and Coke 3½ p.c. max.	76—79	4 8 7	60—60½
4,062,235	"	"	4	4	Gas Light and Coke 4 p.c. Con. Pref.	96—99	4 0 10	75½—76⅜
4,674,850	"	June 11	3	3	Gas Light and Coke 3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	"	"	10	10	Gas Light and Coke 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C	151—154	5 2 4	..
65,780	"	"	6⅛	6¼	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	70—70½
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7		Liverpool 5 p.c. Ord. B	146—148	4 14 7	
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	81
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅔	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	99—99½
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	"	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	"	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 13 4	2¼
499,960	5	June 26	5	2/6	" 5 p.c. Pref.	4¾—5	5 0 0	70/-—72/-
521,600	100	June 2	4	4	" 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	8¼
125,000	50	July 1	5	5	San Paulo 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	"	"	10	10	Do. B	222—224	4 9 3	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	77—78¼
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60½—61½
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	135—138	5 8 8	..
742,275	"	"	6	6	Tottenham District B 3½ p.c.	115—117	5 2 7	..
181,255	"	June 26	4	4	Tottenham District 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/3	55/1½	" C 3½ p.c.	110—115	5 2 0	..
852,000	"	"	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	"	"	6⅜	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Jan. 19.]

For convenience of reference, applications are now arranged alphabetically under the names of the applicants and communicators—the latter being printed in italic type. In the case of joint applicants or communicators, each name is given independently.

Nos. 387—690.

Chandler, D.—"Industrial gas burners and furnaces." No. 685.
Gibbons Bros.—"Machines for discharging and charging gas-retorts." No. 432.
Guest, A. A.—See Gibbons Bros. No. 432.
Hewitt, J.—"Making air and water tight joints." No. 553.
L'Arbre, W. M. D. de.—"Apparatus for the discharge of fluid operated by gaseous pressure." No. 464.
Mercer, A.—"Coin-freed prepayment mechanism." No. 637.
Meters Limited.—See Mercer. No. 637.
South Metropolitan Gas Company.—See Chandler. No. 685.
Tyrer, D.—"Manufacture of phenol." No. 522.
Wigley, J.—See Gibbons Bros. No. 432.
Young, E.—See Mercer. No. 637.

A mill fire at Elland a few days ago, by which considerable damage was caused, is attributed to a heated gas-mantle falling among some partly prepared material.

For a couple of days, Aberystwyth suffered from an interruption in the supply of electric current, owing to a fire, the cause of which is unknown, at the generating station. Damage to the extent of several hundred pounds was done.

Some alarm was caused among the congregation at Lymington Parish Church last Sunday week, when flames were seen shooting upwards from the pulpit while the Vicar was preaching. Electric light is installed throughout the church, and this having fused in the pulpit the minister's surplice was set alight. Fortunately, however, he noticed and extinguished the flames before any serious injury was received by him.

Owing to the difficulty of obtaining sufficient supplies of gas coal, the Hyde Gas Company have asked their consumer to reduce as much as possible the use of gas for cooking and heating purposes.

The Directors of the Weardale and Consett Water Company recommend a dividend at the rate of 7 per cent. per annum on the ordinary stock for the half year ended Dec. 31. This makes, with the interim dividend at the rate of 6 per cent. paid last July, a dividend of 6½ per cent. for the year.

The death occurred on the 12th inst. of Mr. W. Chalmers Blenkarne, who joined the staff of Messrs. Falk, Stadelmann, and Co., Limited, in 1891, and of late years had represented them as a traveller in the southern districts of London. Deceased had the longest service with the firm of any London traveller.

Mr. James Blumer, J.P., of Darlington, who recently severed his connection with the well-known Tees-side firm of Bolckow, Vaughan, and Co., Limited, after over 40 years' service, was for the last 25 years chief salesman. He was prominently identified with the firm's patent coke-oven departure. At that time the Company were purchasing 10,000 tons of coke per week; but now their own plant is producing 11,000 tons per week, besides large quantities of bye-products, such as sulphate of ammonia, toluol, and benzol, and only 2000 tons has to be purchased.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office recently issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "Journal" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Manager. No. 6144.
Assistant to Take Charge. Redhill Gas Company. Applications by Feb. 2.
Clerk. Redditch Gas-Works.
Foreman Fitter. Saltley Gas-Works.
Under Works Foreman. No. 6147.
Main and Service Layers. Aberdare Gas-Works.
Stoker. Willey and Co., Exeter.

Appointments Wanted.

Engineer and Manager, Working Manager, &c. No. 6139.
Representative. No. 6148.

Plant, &c. (Second Hand), for Sale.

Boiler. Tipton Gas Department.

Plant, &c. (Second Hand), Wanted.

"Rapid" Manual Charging Machine. No. 6146.
Vans. Brittain, Camden Town.

Meetings.

Brentford Gas Company. St. Ermin's Hotel. Feb. 11. 2 30 o'clock.
Gas Light and Coke Company. Chief Office, Horseferry Road. Feb. 4. Twelve o'clock.
Imperial Continental Gas Association. Cannon Street Hotel. Feb. 2. 2.30 o'clock.
South Suburban Gas Company. De Keyser's Hotel. Feb. 11. Three o'clock.

Patent Licence.

Gas Water Heater Heron Rogers and Dehn, Broad Sanctuary Chambers, Westminster.

TENDERS FOR

Cookers.

Barrow-in-Furness Corporation. Tenders by Feb. 8.

Fire-Clay Goods.

Barrow-in-Furness Corporation. Tenders by Feb. 8.
Mossley Gas Department.

General Stores (Brass Goods, Oil, Lime, Ironmongery, Sulphuric Acid).

Barrow-in-Furness Corporation. Tenders by Feb. 8.

Meters.

Barrow-in-Furness Corporation. Tenders by Feb. 8.

Pipes.

Barrow-in-Furness Corporation. Tenders by Feb. 8.

Retort Mouthpieces.

Mossley Gas Department.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1916 are reminded that this can only be done before the end of January.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to
Walter King, 11, Bolt Court, Fleet Street, London, E.C.

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LARGEST SALE OF ANY OXIDE.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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FOR

DRY METERS

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SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.

See Illustrated Advertisement, Nov. 16, p. 354.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

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FOR

ALL METERS

TRY

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HUTCHINSON BROTHERS, Ltd.,
Falcon Works, Barnsley.

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(Gas Department.)

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Wages, £3 per Week.

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Two Settings each of Eight Through RETORTS.
32 MOUTHPIECES, complete.

Specifications, &c., may be obtained from the undersigned.

Jos. M'Nicholl,
Engineer and Manager.
Corporation Gas-Works,
Mossley, near Manchester.

COUNTY BOROUGH OF BARROW-IN-FURNESS.
(Gas and Water Department.)

THE Corporation are prepared to receive TENDERS for the Supply of FIRE-BRICKS, CAST-IRON PIPES, WROUGHT-IRON TUBES and FITTINGS, BRASS COCKS, GAS-METERS, GAS-COOKERS, OIL, LIME, IRONMONGERY, and SULPHURIC ACID, as may be required from the 1st day of April next to the 31st day of March, 1917.

Sealed Tenders, on Forms to be obtained at the Office of the Manager of the Gas and Water Works, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Stores," to be Delivered at the Town Clerk's Office on or before Tuesday, the 8th day of February, 1916.

The lowest or any Tender not necessarily accepted.

By order,
L. Hewlett,
Town Clerk.
Town Hall, Barrow-in-Furness,
Jan. 17, 1916.

THE Proprietor of British Patent No. 22 061, 1912, dated Oct. 20, 1911, Relating to "GAS WATER HEATER," is desirous of Entering into Arrangements, by way of a LICENCE or otherwise, on Reasonable Terms, for the purpose of EXPLOITING the above Patent and Ensuring its Practical Working in Great Britain.

All Inquiries to be addressed to Heron Rogers and Dehn, Broad Sanctuary Chambers, Westminster, S.W.

PATENTS.—Handbook of Patent Law, by W. P. Thompson, F.C.S., M.I.Mech.E., C.P.A., International Patent Agent, 6, Lord Street, Liverpool, and Bradford and London. 16th Edition 1915, 242 pages. 2s. 6d. Post free. English Portion, 6d. "A useful guide to inventors. The subject is treated in a simple and concise manner."—Journal of Gas Lighting.

JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST, LONDON

VOL. CXXXIII., No. 2751.] TUESDAY, FEBRUARY 1, 1916. [68TH YEAR.

EDITORIAL NOTES.

Gas Light and Coke Company's Results in the Third Half Year of War.

WERE it not for the facts that the consumers are paying a higher price for their gas, that the proprietors are suffering a reduction of dividend, and the employee co-partners a diminution of their bonus as well as dividend as stockholders, there would be unmitigated gratification by all concerned in the Gas Light and Coke Company over the financial results of the third half-year's working under war conditions. The Company are to-day in a stronger financial position than they have been at any time since normal conditions were wholly superseded by chaotic and strange ones, which have been and are of a heavy and severe order for all gas undertakings, and must have stood at the maximum in these characteristics for the largest undertaking. In connection with the Gas Light Company, there has been in pre-war years a great deal of thankfulness expressed over the rehabilitation of its fortunes under the governorship of Sir Corbet Woodall, D.Sc.; but if ever the Company required a strong head, with an able Board and a skilful staff to support him, it has been during this war. The fact speaks loudly that, after eighteen months of it, the accounts show the Company standing with the minimum of injury, and fortifying their position to meet, it is greatly feared, still worse conditions before improved ones set in with the return of peace.

The Governor will next Friday be able to illustrate all this better than we from the outside can possibly do. There is, however, no difficulty in drawing conclusions from the salient facts presented by the accounts; the trouble is to show by contrast what has happened with any degree of precision in view of the altogether different conditions under which working has been proceding, even compared with the second half of 1914. In that half year, there was one month pursuing its normal peace course, though rumours were busy, and causing uneasiness, as to the possibility of this country being involved in war. There were five months of war. In three months of the half year, the price of gas was 2s. 6d. per 1000 cubic feet; and in the other three months, 2s. 8d. But throughout the past six months 3s. has ruled. Coal prices and rates of freight have been higher; the residuals markets altogether changed their aspects; labour is costing more; and business has been further restricted "by order," with the view of shielding London during the hours of night. There is nothing consistent between the two half years to enable contrast to be made on level terms. But the facts stand out clearly that, despite the total expenditure on revenue account having, compared with the second half of 1914, risen by £331,029, to £2,150,193, the total income being £2,754,507 (an addition of £485,833), the balance transferred to net revenue account is £604,313, which is greater by £154,803. Providing for fixed charges, placing £5000 to the redemption fund, and £10,000 to the special purposes fund (which appropriation was missed in the second half of 1914), the profit balance is £353,427, compared with £230,892, or £122,535 more. With the amount brought from the previous half year, £436,058, there is an available balance of £789,485, which is better by £23,279. But the dividend under the sliding-scale this half year is £4 4s. per cent., as against £4 13s. 4d. twelve months ago; and the former will require £342,870, as compared with the £381,668 needed for the latter. In the result, the amount to be carried forward to the next account is £446,614, which is higher by £62,076 than at this time last year. This view of the stronger position has to be supplemented by an inspection of the spendings and writings off. We see that the charges for repairs, maintenance, and renewals are up to the level of normal times, and higher than in the second half of 1914. In the capital account, it is also observed, plant, meters, and stoves have been depreciated by £128,315, while the additional capital expenditure is £71,897. Investments, too, have been written-down by £24,897. These are matters to be taken into account when considering the financial position; and, so considering them, the proprietors will see that their concern is being well-safeguarded, and the consumers that they are being protected, so far as can be foreseen, against a further advance in price.

The darkest spot in the accounts is the item of coal. Apart from its higher price, the Company have, through torpedoes and mines, had some serious losses in colliers, which, however well covered by insurance, means that, to fill the gap between tonnage owned and tonnage required, the market rates of freight have had to be paid. Coal cost £887,263, or no less than £227,739 more than in the second half of 1914, though the quantity carbonized (829,040 tons) was greater by only 12,388 tons. A more striking comparison is that, although 120,099 tons of coal less were carbonized than in the December half of 1913, the cost was higher by £104,656. The expenditure on oil was £115,694, or £14,847 greater; and on coke and breeze, £59,610, or an advance of £14,765—these higher figures notwithstanding that, as will be seen presently, there was somewhat less carburetted water gas made. The quantity of oil used was 8,070,073 gallons—a diminution of 234,452 gallons. However, from these costly raw materials, there were made 13,856,399,000 cubic feet of gas, or 43,075,000 cubic feet more than in the December half of 1914—the division between the coal gas and the carburetted water gas being 10,604,415,000 cubic feet, and 3,251,984,000 cubic feet respectively. In the second half of 1914, the total make of gas was 13,813,324,000 cubic feet, of which 10,142,459,000 were coal gas, and 3,670,865,000 carburetted water gas. From these figures, it will be seen that 418,881,000 cubic feet less carburetted water gas were made last half year, but 461,956,000 more coal gas. We may digress for a moment to compliment the manufacturing department on the yield of 12,791 cubic feet of gas per ton, compared with 12,419 cubic feet in the December half of 1914, and 12,306 cubic feet in the second half of 1913.

As a partial set-off to the very remarkable figures as to the cost of raw materials, the residual products returned £600,061, or £202,016 more than in the second half of 1914, and £8571 more than in the corresponding period of 1913, although so much more coal was carbonized in the last-named period. The total returns for residuals in the past six months, although not the quantities sold, and therefore not the prices, show an extraordinary coincidence with those for the December half of 1913, as will be observed by the figures in parentheses. Coke produced £369,099, or £125,607 more than in the second half of 1914 (1913, £362,309); breeze £27,900, or £16,877 more (1913, £26,500); tar and tar products, £82,760, or £14,303 more (1913, £89,770); ammoniacal liquor and sulphate of ammonia £120,301, or £45,228 more (1913, £112,910). In passing, it is interesting to observe that there were in store at Dec. 31, 50,682 tons of coke, as compared with 11,658 tons brought into the half year; 61,694 tons at December, 1914; and 92,222 tons at December, 1913. The part that residual products have taken in ameliorating the situation can be seen by a very few figures. The cost of materials for the manufacture of gas was more by £257,351 than in the second half of 1914, and more by £190,841 than in the corresponding period of 1913, notwithstanding the larger business then done. But deducting the income from residuals (£600,061) from the total cost of raw materials (£1,062,567), we have last half year a net cost of £462,506, compared with £407,171 in the second half of 1914, and £280,236 in the December half of 1913, which net costs respectively represent 8·01d., 7·07d., and 4·63d. per 1000 cubic feet. Of course, the differences in these figures are not by any means the only higher costs that the Company have had to incur, as a comparative examination of the accounts discloses. It may be incidentally mentioned here that the Company had coal in store at Dec. 31 amounting to 267,772 tons, which is close to the quantity in store on Dec. 31, 1913—viz., 265,692 tons. The amount in store on Dec. 31, 1914, was 138,839 tons; so that the position in regard to the coal reserves is considerably better than twelve months ago.

The sales of gas present some interesting features. The total amount sold was 12,905,757,000 cubic feet, or more by 178,716,000 cubic feet than in the December half of 1914, but 451,996,000 cubic feet less than in the corresponding period of 1913. It is very satisfactory to find that the private consumers (including shops), in using 12,662,931,000 cubic feet, took more by 314,875,000 cubic feet than in the second half of 1914, and only short of the sales in the corresponding period of 1913 by 224,469,000 cubic feet. But the further restrictions of lighting in the streets resulted in 136,159,000 cubic feet less being consumed in this direction than in the December half year of 1914, and 227,527,000 cubic feet less than in the same period of 1913. From these figures, it will be remarked that the reduction of 451,996,000 cubic feet in the gas sales as compared with the December half of 1913 is about equally divided between the private consumers and the public lighting—224,469,000 cubic feet in respect of the former, and 227,527,000 cubic feet in regard to the latter. The total receipts for gas (at the increased price) in the half year were £1,898,716, or £278,441 more than in the corresponding half of 1914. This increase is all due to private consumption and £2964 besides, seeing that the receipts from public lighting were down by this amount. As private lighting includes shop lighting, and as shop lighting has been compulsorily curtailed so much, the position is, in the circumstances of the times, far from being unsatisfactory. The satisfaction is enhanced by the continued enrolment of gas consumers. Last half year an additional 5367 consumers were placed on the books; and 31,044 gas fires and cookers were sold or let on hire. Further testimony as to expansion of the foundation of business is seen in the fact that the rental of meters, stoves, and fittings has increased by £11,377, to £249,721 since December, 1913—the rental for last half year being by £5466 higher than in the second half of the year 1914.

These are the salient features of the accounts. We will not run over the upward changes, compared with normal times or the second half of 1914, in the outgoings of the half year. They are found in substantial amount in several items on the expenditure side of the revenue account. The main feature for congratulation is that, under the heavily oppressive circumstances in which trading has proceeded, the financial position is so strikingly good.

Close Working in South London.

The accounts of the South Metropolitan Gas Company clearly present the fact that the Chairman (Mr. Charles Carpenter, D.Sc.) and his fellow-Directors, in making their estimates in regard to the raising of the price of gas, though the factors were at the time hazy in the extreme, did not, in fixing upon 2s. 10d., take from the consumers a penny more per 1000 cubic feet than was necessary. What would be the cost of coal at the pithead was fairly well known; there was some amount of doubt as to the expense of transporting coal from the North to London; there was speculation as to whether or not there would be a further falling-off in gas consumption; the markets for residuals were uncertain as to the extent of their upward movements; and the degree of the effect of the shortage of labour, skilled and unskilled, was a source of anxiety, and, as has since been proved, this has materially hampered the Company in their operations. But, with all the ambiguity as to what might happen, the additional price of gas, helped by the partial compensation from residuals to the high price of coal and rates of freights (by the way, the report does not mention anything as to the Company's experience with their own steamers), enables the Directors to recommend the payment of a dividend at the sliding-scale rate of £4 8s. per cent. per annum, and to handle a surplus of £29,176, from which £10,000 has been allocated to the insurance fund (which was greatly depleted as the result of the coal strike), leaving £19,176 to increase to £23,968 the sum carried forward. This is a close result. Nevertheless, looking down the items on the expenditure side of the revenue account, save in regard to coal and two exceptional charges, they are approximately normal in amount. This can be shown by few figures. The total expenditure is £1,152,527, as compared with £885,634 in the corresponding half of 1914, or an increase of £266,893. Mainly due to coal and freights, the manufacturing charges (£829,668) are £232,894 more; the superannuation, sick, and accidents fund is up by about £10,000; and, in place of the item employees' reservists fund, £3207, of twelve months since, there is the charge for war bonus and war fund, £31,505, or £28,298 more. These named extra outgoings overlap the addition of £266,893 to the total expenditure; so that there is no need to traverse in detail the items to the debtor of the revenue account. Mentioning total expenditure, it may be at once pointed out that the sum of the income was £1,370,745, or £305,126 more than in the second half of 1914; and the balance to net revenue account is £218,218, or £38,233 more. In every way, it is seen that the Directors were justified in their estimates in relation to the raising of the price of gas.

The three prominent points of interest are therefore coal, residuals, and sales of gas. As to the increased costs of coal and freights, the Directors are philosophically resigned to the view that "it seems unlikely that any relief from "these burdens can be expected during the war." This view, expressed with a caution that leaves a loophole for improvement if something extraordinary should occur to promote it, is a pretty safe one. The cost of coal during the half year was £646,467, or £242,894 more than in the second half of 1914, though only 7016 tons more coal were used; and it is £180,378 more than in the December half of 1913, although 5061 tons less were carbonized. This close consumption of coal in the three half years with makes of gas widely different, appears to call for a little explanation. Some 552,492 tons of coal were required in the past half year to produce 6,783,474,000 cubic feet of gas; while, in the corresponding period of 1914, 545,476 tons produced 6,880,774,000 cubic feet of gas—the respective makes per ton being 12,278 cubic feet and 12,614 cubic feet. The explanation of this reduction of make per ton is probably shortage of labour, or maybe the quality of the coal—perhaps both; and, as likely as not, there is some other contributing cause. Despite what the Company are doing in the matter of toluol recovery, the official returns show that the gas is being maintained of the high quality that obtained prior to the war; and with the Company quality takes precedence of quantity. Reverting to the expenditure of £646,467 on coal, residuals yielding £397,177 bring the net cost of coal to £249,290 for 552,492 tons. The corresponding figures in the December half of 1914 were: Coal, £403,573, and residuals £237,318—giving a net cost of £166,255 for 545,476 tons. In the December half of 1913, the figures were: Coal, £466,089, and residuals, £328,985—making the net cost £137,104 for 557,553 tons of coal. These net costs work out per 1000 cubic feet of gas as follows: With a make last half year of 6,783,474,000 cubic feet, to 8·81d.; with a make of 6,880,774,000 cubic feet in the corresponding period of 1914, to 5·79d.; and with a make of 7,099,900,000 cubic feet in the second half of 1913, to 4·63d. Therefore the net cost of coal alone last half year was 4·18d. more than in 1913. The income of £397,177 from residual products is £159,859 more than in the corresponding period of 1914, and £68,192 more than in the same period of 1913. Comparing with the second half of 1914, coke, in yielding £267,336, gave £116,247 more; breeze, in returning £7903, £7623 more; tar and tar products, in contributing £65,518, £35,828 more; and sulphate of ammonia, in providing £56,419, £161 more. Regarding the last-mentioned figure, it might have been expected, in view of the ascending market price of sulphate of ammonia during the year, and the larger quantity of coal carbonized, that there would have been a greater difference to the good.

Turning to the sales of gas, the Directors report that there was a decrease equal to 2·03 per cent., contrasted with the corresponding period of 1914, which half year was less by 4·29 per cent. than the same half of 1913. It is interesting to learn that this was entirely due to the earlier closing of shops and the restriction of public lighting, and that the requirements of private consumers were normal, while the demand for power and various manufacturing purposes improved. Coming to total figures, the sales of gas, amounting to 6,218,421,000 cubic feet, showed a reduction of 129,187,000 cubic feet, compared with the corresponding six months of 1914, and of 413,612,000 feet contrasted with the same period of 1913. Of the reduction last half year, making comparison with the December half of 1914, private consumption [why persist in using the term "private "lights"?], including shops, was responsible for 92,785,000 cubic feet, and public lighting for 36,402,000 cubic feet; while of the reduction compared with the six months of 1913, 340,899,000 cubic feet were due to private consumption, and 72,713,000 cubic feet to public lighting. There is really little use contrasting the receipts for gas, as in the Michaelmas quarter of 1914 the price was 2s. 2d., and in the Christmas quarter 2s. 4d., while 2s. 10d. has ruled throughout the past half year. However, for what the figures are worth, they are given. The total income from gas was £846,991, or an increase of £147,522. Of the total, private consumption contributed £833,702, or an increase of £148,750, and public lighting £13,289, or a reduction of £1228. Rentals from meters, stoves, and fires, and income from gas-fittings, gave a total of £125,031, or £2219 less than in the December half of 1914; but the diminution is entirely due to gas-fittings, which yielded £43,352, as compared with £46,077—a reduction of £2725. All along the line of connections, there has been a healthy increase, so that the fabric of the business has been still further reinforced. Ordinary meters have risen by 181, to 95,616; prepayment meters by 5026, to 280,137; ordinary stoves by 2413, to 86,340; slot stoves by 5717, to 234,619; and fires by 4915, to 54,925. There is gratification in these figures, and in the fact that, in the untoward circumstances of the times, the results have come out so well on a 2s. 10d. price that the dividend at the rate of £4 8s. per cent. has been earned in the half year, with a balance in hand.

Sulphate of Ammonia Export Licences.

The announcement made last week as to the temporary suspension of sulphate of ammonia export licences will, in view of the magnitude of our overseas trade in relation to the total production of the United Kingdom, probably have caused some alarm among producers. But there are hopes that, though the announcement is couched in very definite language, the position is not altogether so sinister as on the surface it may appear—at any rate, there is good reason to believe that when the situation becomes, by the fact of growing stocks, a little clearer to the comprehension of the Board of Agriculture and the Board of Trade, any withholding of licences to export will soon be relaxed. The notification issued last week commenced with these words: "In view of the uncertainty as to the sufficiency of the "supplies of sulphate of ammonia to meet home demands "during the next few months, it has been decided, on the "recommendation of the Fertilizers' Committee, with the "approval of the President of the Board of Agriculture and "Fisheries and the President of the Board of Trade, to "suspend, for the present, the issue of licences."

This notification is, no doubt, the result of agitation among the farmers in regard to the provision of fertilizers and their prices, of questions and pressure in the House, and of, above all, an admitted inappreciation of the actual position On any one, or the whole, of these grounds, the suspension of licences is altogether unjust. The notification, it will be observed, starts with the confession as to the want of knowledge respecting the sufficiency of the supplies of sulphate of ammonia to meet home demands; and yet the second paragraph begins with the statement that, "under "normal conditions, it is well known that the production of "sulphate of ammonia considerably exceeds home require- "ments." When these two statements are brought into juxtaposition, it would appear to any business man that this was essentially a case calling for the adoption of a middle course, rather than the drastic one suggested. If, however, there was any real uncertainty existing in the minds of the Fertilizers Committee and the Board of Agriculture, they have not, so far as we are aware, taken any independent action in trying to ascertain the facts, and so displace the uncertainty by certainty. Yet the Sulphate of Ammonia Association have placed before them data which should either have satisfied them, or supplied them with a case for making further investigation on their own account, as to what was likely to be the home requirements for sulphate of ammonia for which adequate provision should be made. This, in view of the acknowledged uncertainty, apparently they have not done. Instead, they have at the moment taken the easiest course, without bestirring themselves to follow a suggestion made to them three months since by the Committee of the Sulphate of Ammonia Association, who have been far-seeing and active in relation to the very situation which has now arisen, and which they have done their best to avert, in their conviction, from inner knowledge, that no such drastic action as the entire suspension of export licences (temporary or otherwise) would be necessary. In every way, the Association have met the Board of Agriculture, and done all that was actually requisite to provide for home demands.

Seeking information, Mr. D. Milne Watson, the Chairman of the Association, handed us a circular-letter which, towards the close of last week, was addressed by the Committee to the makers of sulphate of ammonia, and which letter is published in another column. It refers to the suggestion that was made by the Committee of the Association some three months since. They then urged the Government to take steps to obtain information relative to the production, and probable consumption, of sulphate of ammonia in the spring, together with returns from export merchants as to the quantities already sold to foreign countries. This suggestion has been carried out, and it has thus been possible to make an approximate forecast as to possible requirements and supplies, and so determine in advance the quantity that would be available for export each month. The object that the Committee had in mind in making their suggestion was that export licences should be granted at the beginning of each month for the estimated surplus, and that further licences should be issued towards the end of the month if the surplus was greater than had been computed. This would have been a sensible, systematic, and businesslike proceeding. The Government have in their possession particulars regarding the quantities already sold to overseas countries; so that it would have been perfectly easy to have allocated the export licences in proportion to the purchases made by each country—giving such preference to our Allies as might have been deemed necessary. But evidently the Government do not intend to make use of this fundamental information.

Obviously, the Government are proceeding upon false assumptions as to the absorptive power of our agriculturists. Last year the home consumption of sulphate of ammonia for all purposes was about 115,000 tons; and the exports some 294,000 tons. The quantity exported would be a heavy one for this country to absorb. But the notification as to the suspension of exports of sulphate of ammonia appeals to farmers of the country to increase their demands for fertilizers "of all descriptions," in order to stimulate the production of foodstuffs, and to place their orders for sulphate at once so as to enable the expected increased demand to be met without undue delay or difficulty. The Board of Agriculture and other interested departments are either over-sanguine as to the probable response by, and needs of, the farmers of the United Kingdom, or they prefer to be relieved of trouble by making over-provision, without due inquiry, by the simple expedient of totally suspending export licences (except in so far as licences for contracts made before a specified date are concerned), and without much care for the position of the sulphate of ammonia producers. The injustice does not end with the producers. It extends to overseas customers; and it is quite certain that, if persisted in (though there is little fear of this when experience of home demand clears the vision of the Government authorities), it would militate against this country's position when after-war competition sets in with full severity.

However—apart from the statement of Mr. Acland in the House of Commons last Thursday night, that it would be impossible to continue the withholding of licences indefinitely—there is some consolation in respect of the notification as to the present suspension of licences in a letter received by sulphate of ammonia makers from the Board of Agriculture. They ask that returns shall be made on the 1st and 15th of each month, showing the position of the stock of individual producers. Concerning this, the Committee of the Sulphate of Ammonia Association urge that, in view of the existing great difficulty in shipping sulphate, it is desirable that licences should be available before the storage accommodation at a works is absolutely exhausted, inasmuch as there will probably be an interval of at least a fortnight between the issue of licences and the possibility of shipping. The advice is therefore tendered that the Board of Agriculture should be advised before there is danger of the works becoming overstocked. Observation of this advice will operate not only in relieving individual makers, but will assist in modifying a position created by the insufficient knowledge possessed by the Board of Agriculture as to possibilities.

The circular-letter from the Association, as will be seen, also deals with some other matters—among them the agreed prices for home supplies; and it is quite clear from what is stated that the Board of Agriculture have not kept faith with the Association in respect of the understanding arrived at in regard to spring supplies. Pressure was, subsequent to the undertaking, brought to bear which led to the fixing of a maximum price, conditional (in view of the increased expenses of production, which Mr. Acland recognizes) on the Government taking the necessary steps to see that sulphuric acid was provided at a reasonable cost. But the Government shirk taking action to control the prices of sulphuric acid, probably through the influence brought to bear within the House itself.* The Committee of the Sulphate of Ammonia Association feel keenly over, and speak boldly as to, this matter. "We have sufficient evidence," they remark, "to "show that acid manufacturers are taking advantage of the "shortage of supplies in a scandalous manner." Probably they are applying, under war conditions, the much-abused law of supply and demand, which law, when the demand exceeds the supply, enables producers who are not controlled by a fair spirit to satisfy an inordinate greed for profits. This sulphuric acid question is one calling for as much pressure as possible being brought upon the Government; and as it is a matter in which not only makers of sulphate of ammonia but home buyers are concerned, they should respectively take steps to urge the Government to exert controlling action. It is not justice to press for the limitation of the price of a commodity, when the cost of an important necessary to its production is allowed to take an unrestricted upward flight. However, the work of Government Departments in connection with conditions arising from the war are marked by most flagrant inconsistencies.

National Coal Reserves and Economy.

In his second lecture at the Royal Institution, Professor W. A. Bone pursued the theme of the utilization of coal in the most efficient ways, with the twofold object of realizing the highest possible economy, and securing from the coal the utmost possible value—to the national benefit, present and future. The second lecture, if anything, exceeded the first one in interest, for an audience of composite character—scientists, technologists, and the general public were there; for Professor Bone had several matters of an informative character to impart, and he also got on to the lines along which work must proceed to secure the wealth to be derived from the more efficient use of our expenditure of raw coal. He enforced the necessity for economy in the national interests by showing the proportion of our coal reserves compared with those of other countries. When we come to consider that of the total estimated world's reserves, Great Britain appears rather low in place in the percentages, it makes us ponder over that (happily distant) future when our successors will probably lose their industrial and commercial supremacy for want of cheaply worked supplies of coal, and will then have to turn importers—thus putting an end for ever to the vexed questions of coal exports, the wasteful utilization of our native substance, and many other matters that are polemical in connection with coal to-day.

It is essential that the public should realize the national position in regard to coal reserves, though the public are, as a rule, very indifferent to matters that will be the immediate concern of a somewhat far-off posterity, and is not their own. The United States can boast of the largest percentage possession of the estimated reserves in the world; and when we see that they can claim more than half the total—51·8 per cent.—it is not difficult to peer into the centuries ahead, see visions, and indulge in prophecy, as to what will happen—eventually. The percentage of the world's reserves held by Great Britain is only 2·6—less than one-half that held by Germany. But happy are we in our Dominions beyond the seas; for Canada stands second in the list, with a 16·4 per cent. share in the reserves. Australia has also 2·2 per cent. to her credit—the three items making a total of 21·2 per cent. In the sum, our position is good; but 18·6 per cent. of it is not here. Considering these figures, it must be remembered that our industrial and commercial position has been built up on a cheap supply of easily won coal. Increasing depths, and enhanced costs for wood, labour, &c., mean that coal will never again be so cheap as in the past, unless something miraculous befals. And the Government will, therefore, be lacking in their duty to the country now and hereafter if they do not begin now to do everything possible to improve our economic position through coal, and to protect in ways conspicuously absent in the past this essential to the present and future of our trade position and expansion. We cannot now afford to lose anything that could be brought to our gain; and it is a trust for the discharge of which we are responsible to our country that there shall not be longer than can be avoided any prodigal living in regard to coal. The longer there is postponement of the work of realizing attainable economy, the more difficult will be the task.

Professor Bone considers the question of the statistical exercises that have been from time to time performed as to the probable duration of our coal supply, and dismisses them as being of academic interest, but of little practical value. He is right in this. The question for us is one of comparison with our trade competitors of other nations—in other words, how long shall we be able to get coal at home at a price that will not place us at a disadvantage relative to our nearest trade competitors. There is a point, fundamental and vital, for our political economists, who have not yet been sufficiently wise to carry their penetration, in preparing their trade-expansion disquisitions, to the very bedrock of our industrial prosperity. Speak to them on this subject, and some will begin to babble of the reduction of exports as a means of preservation of the part of our stores of coal that is the cheapest to raise. Professor Bone is not a willing controversialist over points of policy of this kind; but he cannot see that coal exports and our maritime supremacy can be dissociated. The one, in his opinion, goes with the other. Whether, however, there is anything that is likely to arise from an expansion of home industries and that will offer compensation in exports to a reduction of the quantity of coal shipped, he does not say, and we cannot predict; it is a point that rests with the evolution of our national affairs. But he leaves speculation for more practical ways of producing economy; and comment upon these can remain until we have before us the third and final lecture, though many suggestions as to both industrial and domestic sources of economy are embodied in the one that is published to-day.

Sliding-Scale Suspension

Regarding the suggestion put forward in these columns more than once, that an attempt should be made to secure the suspension of the sliding-scale under the extraordinary circumstances of the war, the view was expressed last week that (for having effect during the war period) the time had passed when there was a chance of the matter being considered by Parliament, in view of the recent resolve as to the character of the legislation to which, while the war lasted, there is willingness to devote attention. As has been pointed out in these columns, such conditions as those brought about by the war were never contemplated at the inception of the sliding-scale; and, apart from the war, we are in the future likely to have very extraordinary conditions with which to contend, and which may bear severely upon gas investors under the sliding-scale. Therefore, in these circumstances, it would be an excellent thing if it were possible to invest the Board of Trade with the power of suspension of the sliding-scale when, in their opinion, circumstances justified. The present time would be particularly opportune for raising this question, if Parliament would bestow consideration upon it; but it is pretty certain that they would not. The matter would also have to be brought forward in the name of sliding-scale companies generally. It would be little good for individual companies introducing the question, in view of the fact that the sliding-scale is a piece of general gas legislation which would have to be dealt with, in respect of any modification, on a general basis.

And Hesitation.

But the only Association that could organize an application to Parliament for the suggested amendment are not, we understand, prepared to do so—not because the present time is inopportune, but because they fear "reprisals." In other words, although the sliding-scale does not make provision for an appeal under exceptional circumstances, it is thought that it would be distinctly disadvantageous to the industry to urge any change in the conditions. It is considered that, if an attempt were made to vary the sliding-scale in consequence of current circumstances, the probabilities are that, when conditions are more favourable to sliding-scale companies, there would be an endeavour to secure an alteration in the sliding scale in favour of the consumers. Really we cannot see what the gas industry has to be afraid of; and we must dissent entirely from the submission that, "in a sense, the sliding-scale was designed to meet" circumstances such as the present. If this were true, then, when to-day we view certain depreciated dividends and gas stock and share values, the thought crosses the mind that a very bad job was made of the fitting of the sliding-scale to meet extraordinary conditions. Some provision is required for this purpose, because some sentient observers are of opinion that extraordinary circumstances are not going to be confined to the war, but are likely to arise for this country rather more frequently in the future than in the past.

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* As we go to press the Sulphate of Ammonia Association inform us that the Government have at length decided to "control" the acid manufacturers. It is satisfactory to hear that the Association's representations have induced the Government to take the first indispensable step towards obtaining control; and it is to be hoped that a real attempt will now be made to regulate prices and distribute supplies of this fundamental necessity of the whole chemical industry in the manner most consonant with national interests as a whole.

Municipal Loan Charges.

The occasion has now arrived which will put to a severe test very many manners and methods in relation to which no serious trouble was likely to arise so long as times of peace and plenty ruled. With the urgent need for economy in public expenditure, has come the problem of finding directions in which it may be fruitfully exercised. But these, to produce savings of any moment, are not always easy to find; though in the smaller things, much ingenuity in cutting-down has been manifested. One has read of the local authority who decided to save in the printing bill by omitting from their records the commas and other marks of punctuation; of another body who have determined to mix coke with the coal for their fires; and of a resolve to provide nurses with a medium weight cloak suitable for wearing all the year round. Beyond their possible value as signs of a desire to save, such actions as these are likely to prove of but little use to ratepayers. The putting off of work requiring to be done may in the end, too, prove to be a dearly bought saving; while in the main the financial policy must be ruled by the system created in the past. The endeavours made to secure the suspension of the operation of sinking funds for the period of the war had reference to what is an important part of the burden of local governing authorities; and "Surveyor," in a second article [his first was noticed recently] dealing with the financial affairs of Liverpool, deplores the fact that the City Council have for years, "in accordance with a long-established municipal principle, been piling-up debts, and through postponing one evil day have created another." No doubt, it is at a time when economy is called for that the question is asked whether the system which has been in vogue for so many years, of borrowing money for municipal undertakings, is a wise one. But it is useless to ask it now—when money, except in very exceptional circumstances, cannot be borrowed at all. "Surveyor" should reprint after the war his plea for the overthrow of the loan principle. He may then succeed in inducing municipal bodies to radically alter their policy and ratepayers to take a more intelligent and abiding interest in local government affairs. But this is certainly a good deal to hope for.

To-morrow (Wednesday) evening the Society of Public Analysts hold their annual general meeting; and after the formal business has been transacted, Mr. W. J. Burgess will read a paper entitled "Notes on Common Processes Used in Water Analysis."

We have received from Messrs. Crosby Lockwood and Son a copy of "Sulphuric Acid and Sulphur Products," by Geoffrey Martin, D.Sc., and Major J. Louis Foucar, B.Sc. Pending a fuller notice of the work, it may be mentioned that the book is published at 7s. 6d. net.

The Illuminating Engineering Society will hold their next meeting at the Society of Arts, Adelphi, on the 22nd inst., when there will be a discussion on "Some Future Possibilities in the Design of Instruments for Measuring Illumination (with Special Reference to Photometers Depending on Physical and Chemical Methods)."

At the meeting of the London Section of the Society of Chemical Industry on the 6th prox., Professor W. A. Bone will read a paper on "The Economy of Fuel." At the Newcastle Section meeting on Wednesday, the 16th inst., Professor H. E. Armstrong will deal with the "Problems of Coal with Reference to the Proper and Complete Utilization of our Coal Supplies."

PERSONAL.

Mr. ARTHUR VALON has recently been appointed military representative to the Chiswick local tribunal in the 7th R.D. recruiting area.

Lieutenant R. STALEY, R.E., reported wounded, was, prior to enlistment, Works Superintendent of the Londonderry Gaslight Company. He is a native of Derby.

We hear that Mr. MAURICE GRAHAM, who has been working for the Ministry of Munitions at Plymouth for some months (having given his services in the carrying out of important work), has been offered, and has accepted, a position as Director under the Ministry, and will now be transferred to a sphere wherein his practical experience should show good results. We wish him all success in the work he has undertaken.

Deep sympathy will be felt with Mr. Thomas Glover, of Norwich, whose son Second-Lieutenant S. L. GLOVER has been officially recorded as missing. With a photograph, the "Eastern Daily Press" last Wednesday published the following information relating to Lieutenant Glover: He joined the Public Schools Battalion with other well-known Norwich lads. He was trained at Aldershot and elsewhere, and received a commission on Jan. 1 last year in the 10th West Riding Battalion (Duke of Wellington's). The young officer was sent abroad last August, and soon went to the front, where he did a considerable amount of patrol work, and gained important information from time to time.

In the list of officers mentioned in Sir John French's despatch dated Nov. 30 for "Distinguished Service in the Field" appears the name of Lieut. E. W. BENNETT, a member of the Brentford Gas-Works staff. This gallant young fellow at the outbreak of the war joined His Majesty's forces as a motor despatch rider, and was immediately sent out with the Expeditionary Force to France. Later on he was gazetted to a commission in the motor machine gun service; and, on Sir John French's recommendation, he has been awarded the Military Cross. Another employee of the Company, Sergeant L. A. TITCOMBE, who is serving in the 1/8 Battalion Middlesex Regiment, and has been in the thick of the fighting on the Western Front, has been awarded the D.C.M. for gallant conduct in the field.

The Victoria Cross has been conferred on Corporal ALFRED BURT, of the 1st Battalion of the Hertford Regiment (T.F.), an old employee of the Hertford Gas Company, for conspicuous bravery at Cuinchy on Sept. 27 last. His company had lined the front trench preparatory to an attack, when a large minenwerfer bomb fell into the trench. Corporal Burt, who well knew the destructive power of this class of bomb, might easily have got under cover behind a traverse; but he immediately went forward, put his foot on the fuse, wrenched it out of the bomb, and threw it over the parapet, thus rendering the bomb innocuous. His presence of mind and great pluck saved the lives of others in the traverse. The gallant corporal went to Hertford as a fitter's boy after leaving school; and he later on was with the Basingstoke Gas Company as a fitter until just before war broke out, when he joined his regiment.

OBITUARY.

Mr. JOHN A. DAVIS, who died with startling suddenness while presiding at a meeting at the Kilkenny Town Hall, was Secretary of the Kilkenny Gas Company, and acted as agent for the Marquis of Ormonde's property in the city.

The death took place last Wednesday night, after a brief illness, of Mr. THOMAS J. CARLESS. Deceased, who was in his 89th year, was the oldest Director of the Richmond Gas Company, of which he had for a very long time occupied the position of Chairman. For over half-a-century he served on the Richmond Select Vestry; and on the occasion of his jubilee as a member, a resolution was passed placing on record the Vestry's high appreciation of his work.

By the death last Friday of Sir HUGH OWEN, G.C.B., in his 82nd year, the Gas Light and Coke Company have lost a Director who will be greatly missed by his colleagues. He was for many years a member of the Court of the Company, and was re-elected to his seat at the shareholders' meeting in February, 1914. Sir Hugh, who was also a Director of the Hornsey Gas Company, was one of the Arbitrators appointed (along with Sir Edward Fry, who acted as Chairman, and Sir John Wolfe-Barry), under the Metropolis Water Act of 1902, to determine the price to be paid by the Metropolitan Water Board for the undertakings of the London Water Companies. The Arbitration Court commenced their sittings in May, 1903. He became Permanent Secretary of the Local Government Board in 1882, and continued to hold this office for sixteen years.

Scottish Junior Gas Association Prizes.—The Council of the Scottish Junior Gas Association (Western District) announce that, as a result of the decisions (by letter) of the five members who were asked to act as adjudicators of last session's papers, the first prize goes to Mr. David Fulton, of Helensburgh, for his paper on "Carbonization in Vertical Retorts;" and the second prize to Mr. Archibald P. Dale, of Beith, for his paper entitled "A Country Gas-Works—Past and Present."

THE GAS LIGHT AND COKE COMPANY.

Half-Yearly Report and Accounts.

The following is the report of the Directors of the Gas Light and Coke Company for the half year ended Dec. 31, which, with the accounts [some particulars from which are given below], will be presented at the ordinary general meeting on Friday.

The accounts for the past half year show that, after providing for fixed charges, setting aside £5000 towards the redemption fund, and contributing £10,000 to the special purposes fund, there remains a profit balance of £353,427 5s. 11d. The amount brought forward from the previous half year being £436,058 11s. 8d., there is a total available balance of £789,485 17s. 7d., out of which the Directors recommend the payment of a dividend on the ordinary stock at the rate of £4 4s. per cent. per annum, which will absorb £342,870 17s. 8d., and leave £446,614 19s. 11d. to be carried forward to the credit of the current half year.

The sales of gas for the half year show an increase of nearly 1½ per cent. compared with the quantity sold during the corresponding period of 1914.

There has been an increase during the six months of 5367 in the number of consumers, and of 31,044 in the number of gas-stoves sold and let on hire.

The freights paid for coal and oil continue at a very high level, and show an enormous increase over those of pre-war times.

The Directors have written-down the value of the Company's invested funds by £24,897.

The quinquennial re-valuation of the Company's property has now been concluded, and has resulted in material reduction of the assessment.

The shareholders will be pleased to know that about 2600 of the Company's employees have joined His Majesty's Forces.

The Court of Directors has been furnished by the several Engineers of the Manufacturing and Distributing Departments with certificates that all the Company's works and plant have been maintained in thorough efficiency.

CORBET WOODALL, *Governor.*

Horseferry Road, Westminster, S.W., Jan. 20, 1916.

The Accounts.

The accounts accompanying the report consist of the usual statements.

The statement of capital (stock) sets forth that the total paid-up is £10,413,480; added on conversion, £12,832,955—total amount authorized, £23,246,435. Deducting the amount redeemed, £257,015, the total amount of the Company's existing capital powers is £22,989,420. The statement of loan capital stands thus: Total paid up, £3,186,660; added on conversion, £1,618,190; unissued, £750,000—total amount authorized, £5,554,850.

The capital account shows receipts (with premiums, £1,688,957 14s. 8d.) to the amount of £29,513,247 14s. 8d. The expenditure is shown in the following items:—

Expenditure to June 30, 1915		£14,824,540 5 1
Expenditure during the half year to Dec. 31, 1915—viz.:—		
Lands acquired, including law charges	£5,415 16 11	
Buildings and machinery in extension of works	2,430 0 0	
New and additional mains and service-pipes	8,965 10 2	
Do. do. meters	14,911 12 8	
Do. do. stoves	40,174 15 5	
		71,897 15 2
		£14,836,438 0 3
By depreciation of plant	£65,149 11 2	
„ depreciation of meters and stoves	63,166 7 0	
		128,315 18 2
Total expenditure		£14,708,122 2 1
Nominal amount added on conversion		14,451,145 0 0
		£29,219,267 2 1
Deduct amount of capital redeemed under Company's Act of 1903		257,015 0 0
		£28,962,252 2 1
Balance of capital account		520,975 12 7
		£29,483,227 14 8

The total of the net revenue account is £1,040,372 7s. 11d., compared with £984,824 on Dec. 31, 1914. The balance applicable to the redemption fund and to dividend on the ordinary stock is £794,485 17s. 7d.; and the following statement shows how it is proposed to appropriate it:—

Dec., 1914.		
£535,314 ..	Net balance brought from last account	£436,058 11 8
240,892 ..	Net revenue for the half year	358,427 5 11
£776,206		£794,485 17 7
10,000 ..	Contribution to redemption fund	5,000 0 0
£766,206		£789,485 17 7
(£4 13s. 4d. p. ct.)	Dividend on the ordinary stock—	
£381,668 ..	£4 4s. per cent. per annum on £16,327,185	342,870 17 8
£384,538 ..	Balance carried to next account	£446,614 19 11

The three statements relating to the reserve, special purposes, and depreciation funds stood as follows on Dec. 31: Reserve fund, £75 847; special purposes fund, £322,149; depreciation fund, £80,815.

REVENUE ACCOUNT—*Expenditure.*

December Half Year, 1914.		£ s. d.	£ s. d.
	Manufacture of gas—		
£659,521	Coal, including all expenses thereon	887,263 2 10	
100,847	Oil „ less value of oil tar	115,694 10 0	
44,845	Coke and breeze used in the manufacture of carburetted water gas	59,610 3 8	
15,815	Salaries of engineers and other officers at works	16,191 6 4	
91,280	Wages	102,137 12 6	
13,556	Purification	11,575 13 9	
210,935	Repair and maintenance of works and plant, materials and labour, less received for old materials, £4912 7s. 1d.	261,895 1 7	
			1,454,367 10 8
	Distribution of gas—		
59,524	Salaries and wages of officers (including rental clerks)	63,545 5 9	
93,329	Repair and maintenance of mains and service-pipes, &c.	96,285 1 6	
88,904	Repair and renewal of meters	92,754 12 8	
104,499	„ „ stoves	107,378 17 0	
16,232	Gas-fittings, including labour (automatic meter supplies)	13,536 10 1	
			373,500 7 0
28,446	Public lamps—lighting and repairing	..	29,097 3 6
	Rents, rates, and taxes—		
7,110	Rents payable	7,306 1 10	
162,418	Rates and taxes	172,511 5 10	
			179,817 7 8
	Management—		
3,750	Directors' allowance	3,750 0 0	
300	Company's Auditors and Assistant	304 4 0	
9 728	Salaries of General Manager, Secretary, Accountant, and clerks	10,274 0 3	
27,101	Collectors and cashiers	28,849 7 11	
5,518	Stationery and printing	5,586 11 8	
8,103	General charges	7,393 6 10	
			56,157 10 8
17,000	Co-partnership, for the half year	..	4,600 0 0
67	Parliamentary charges	..	123 15 10
1,020	Law charges	..	485 14 7
..	Charges *re* Quinquennial re-valuations	..	1,050 0 0
6,076	Bad debts	..	7,676 0 0
500	Depreciation fund for works on leasehold lands	..	500 0 0
27,859	Annuities to officers and workmen, including contribution to officers' superannuation fund	..	27,135 12 5
7,124	Allowances to employees on Active Service	..	7,165 11 3
2,011	Workmen's compensation	..	2,786 17 11
4,317	Company's Contribution under National Insurance Act, 1911	..	4,218 6 11
	Public officers—		
860	Gas Referees and Official Auditor	857 2 0	
566	Public testing stations	653 12 3	
			1,510 14 3
1,819,164			2,150,193 12 8
449,510	Balance carried to net revenue account		604,313 16 3
2,268,674			2,754,507 8 11

Revenue.

December Half Year, 1914.		£ s. d.	£ s. d.
	Sale of gas—		
£1,569,791	Per meter at 3s. and 2s. 10d. per 1000 cubic feet	1,851,195 15 9	
50,484	Public lighting and under contracts	47,520 9 2	
1,620,275			1,898,716 4 11
75,358	Rental of meters	..	76,743 7 6
75,509	Rental of stoves	..	78,892 1 5
93,388	Rental of fittings	..	94,086 0 11
	Residual products—		
243,492	Coke, less labour, &c.	369,099 4 9	
11,023	Breeze, less „ „	27,900 10 2	
68,457	Tar and tar products	82,760 14 8	
75,073	Ammoniacal liquor and sulphate of ammonia	120,301 5 2	
398,045			600,061 14 9
5,926	Rents receivable		5,808 1 11
173	Transfer fees		199 7 6
2,268,674			2,754,507 8 11

The remaining statement is the balance-sheet, which gives the value of the stores on hand at the close of the half year as follows: Coal, £289 528; gas oil, £88,658; coke, £32,943; tar and ammoniacal liquor and products, £146,132; and sundries, £401,364. The figures this time last year were: Coal, £112,762; gas oil, £2[illegible],115; coke, £32,389; tar, ammoniacal liquor, and products, £136,057; sundries, £357,009.

Statement of Coal.

—	In Store June 30, 1915.	Received During Half Year.	Carbonized During Half Year.	Used During Half Year.	In Store Dec. 31, 1915.
	Tons.	Tons.	Tons.	Tons.	Tons.
Coal	181,300	917,267	829,040*	1755	267,772

* In addition to this quantity of coal, 8,070,073 gallons of oil were used during the half year.

Statement of Residual Products.

Description.	In Store, June 30, 1915.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store Dec. 31, 1915.
Coke—tons	11,658	514,115	101,301	373,790	50,682
Breeze—tons	1,235	126,960	13,969	93,123	21,103
Tar, from coal only—galls.	2,276,431	8,197,334	8,047,566	357,506	2,068,693
Ammoniacal liquor—butts	20,081	223,277	214,669	..	28,689

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold. Public Lights and Under Contracts (Estimated).	Quantity Sold. Private Lights (per Meter).	Total Quantity Accounted for.	Number of Public Lamps.
Thousands.	Thousands.	Thousands.	Thousands.	
*13,856,399	242,826	12,662,931	13,082,990	44,740
†13,813,324	378,985	12,348,056	12,895,929	44,768

* Including 3,251,984,000 cubic feet of carburetted water gas. † December half year, 1914.

SOUTH METROPOLITAN GAS COMPANY.

The Directors' Report and the Accounts.

THE following is the report of the Directors of the South Metropolitan Gas Company for the six months ended the 31st of December, which, with the accounts (an abstract of which appears below), will be presented to the proprietors at the half-yearly meeting to-morrow week.

After payment of dividend at the sliding-scale rate of £4 8s. per cent. per annum, the working results for the half year show a surplus of £29,176. Placing £10,000 of this to the insurance fund (which was greatly depleted as a result of the coal strike), the balance of £19,176 will increase the amount carried forward to £23,968.

The governing factor of the accounts is, as usual, the cost of coal and freight; and it seems unlikely that any relief from these burdens can be expected during the war. The increased price of gas and the reduction of the dividend and co-partnership bonus, would have been insufficient of themselves to meet these excessively high charges, but some improvement has taken place in the value of residual products.

There is a further reduction in the amount of gas sold equal to 2·03 per cent. below the figure for the corresponding half year, which itself was less by 4·29 per cent. than that of the comparable pre-war period. This result is entirely due to the earlier closing of shops and the restriction of public lighting. The requirements of private consumers are normal, while the demand for power and manufacturing purposes has improved.

Owing to the heavy cost of coal and freight, which has continued too long to be regarded as of a temporary character, it has become necessary to increase the floating capital of the Company to meet these requirements. The Board are therefore asking the consent of the shareholders to the promotion of a Bill for this purpose in the coming session of Parliament—the Wharncliffe meeting being held immediately after the ordinary half-yearly meeting on the 9th inst.

Shortage of labour, both skilled and unskilled, has been a source of great anxiety to the officials during the past few months, and has materially hampered the Company's operations. Of the Company's staff, 2218 are serving with His Majesty's Forces.

The post of Chief Engineer has been filled by the appointment of Mr. G. M. Gill, formerly Assistant Engineer to the Commercial Gas Company.

Two Directors (Mr. Frank Bush and Mr. Frank Harding Jones) and one Auditor (Mr. Thomas Spooner Soden) retire by rotation. They are eligible, and offer themselves for re-election.

CHARLES CARPENTER, Chairman.

709, *Old Kent Road, S.E.*, *Jan.* 26, 1916.

The Accounts.

The following are the principal portions of the accounts accompanying the preceding report.

The first two statements relate, as usual, to the stock and loan capital. The former sets forth that the standard rate of 4 per cent. is payable on £6,011,224 and £598,671 (Act of 1901) of stock; while the latter shows that the loan capital, the rate of interest on which is 3 per cent., amounts to £1,798,994 and £96,451 (Act of 1901). The third statement is the capital account. It stands as follows: Amount received, £5,476,420; nominal amount added by conversion (less premium), £3,028,920—total, £8,505,340. The items of expenditure are as follows:

Capital account to June 30, 1915.		£5,215,736 17 1
Expenditure during half year to Dec. 31, 1915—viz.:		
New buildings and machinery	£33,699 0 0	
New and additional mains and services	2,568 0 3	
New and additional meters	2,395 11 0	
New and additional stoves	4,348 2 8	
		43,010 13 11
Total expenditure		£5,258,747 11 0
Balance		217,672 9 0
		£5,476,420 0 0
Nominal amount added by conversion, less premium		3,028,920 0 0
Total		£8,505,340 0 0

REVENUE ACCOUNT—*Expenditure.*

Manufacture of gas—		
Coal into store, including £4455 19s. 11d. for London Port and tonnage dues	£646,467 17 10	
Purification	12,551 16 9	
Salaries of Engineer and Officers at works	19,101 10 1	
Wages (carbonizing)	52,027 5 6	
Repairs and maintenance of works and plant, less £4444 18s. 5d. received for old materials	99,520 5 2	
		£829,668 15 4
Co-partnership		7,000 0 0
Distribution of gas—		
Repair, maintenance, and renewal of mains and service-pipes	£37,822 13 2	
Salaries and wages of officers, including rental clerks	23,083 0 9	
Repair and renewals of meters	32,527 14 0	
Repair and renewals of stoves	34,498 13 2	
Repair and renewals of gas-fittings	30,782 14 5	
		158,714 15 6
Public lamps, labour and materials £15,152 2s. 7d., less £14,085 1s. 8d. received for the same		1,067 0 11
Rents, rates, and taxes—		
Rents payable	£1,422 15 3	
Rates and taxes	57,700 13 2	
		59,123 8 5
Management—		
Directors' allowance	£2,810 14 2	
Salaries of Secretary, Accountant, and clerks	3,755 5 1	
Collectors { Ordinary	5,790 13 6	
Collectors { Slot meter	11,737 19 2	
Stationery and printing	3,754 17 3	
General charges	13,024 16 10	
Company's Auditors	112 10 0	
		40,986 16 0
Miscellaneous—		
Law charges		2,139 7 10
Parliamentary charges		18 4 6
Bad debts		2,222 10 9
Stolen from 561 slot meters broken open		110 7 8
Superannuation, sick, and accident funds		16,810 4 9
National Insurance Act charges		2,305 7 4
Gas Referees and Official Auditor		354 12 8
Leasehold renewal fund		500 0 0
War Bonus and War fund		31,505 10 3
Total expenditure		£1,152,527 1 11
Balance carried to net revenue account		218,218 9 6
		£1,370,745 11 5

Receipts.

Sale of gas—		
Michaelmas at 2s. 10d. per 1000 feet	£349,087 4 2	
Christmas, at 2s. 10d. per 1000 feet	484,615 1 1	
	£833,702 5 3	
Public lighting	13,289 7 10	
		846,991 13 1
Meters at rent: Ordinary, 95,616; slot, 280,137	£43,206 3 6	
Stoves at rent: Ordinary, 86,340; slot, 234,6 9; fires, 54,925	38,472 17 5	
Gas-fittings at rent	43,352 2 4	
		125,031 3 3
Residual products—		
Coke, less labour and cartage	£267,336 4 4	
Breeze, " "	7,903 7 11	
Tar and tar products, less labour	65,518 9 3	
Sulphate of ammonia " "	56,419 8 3	
		397,177 9 9
Rents receivable		1,474 12 10
Transfer fees		70 12 6
Total receipts		£1,370,745 11 5

Total amount paid in salaries for half year, £45,074 19s. 4d.
" " " wages " £293,162 9s. 3d.

The net revenue account shows a sum of £169,386 applicable to dividend on the ordinary stock. The balances of the reserve, renewal, and insurance funds stood as follows on Dec. 31 last: Reserve fund, £200,972; renewal fund, £27,535; insurance fund, £36,613.

Statement of Coal.

In Store June 30, 1915.	Received During Half Year.	Carbonized During Half Year.	Used During Half Year.	In Store Dec. 31, 1915.
Tons.	Tons.	Tons.	Tons.	Tons.
153,498	627,503	552,492	1309	227,200

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold. Public Lights (estimated).	Quantity Sold. Private Lights (per Meter).	Total Quantity Accounted for.	Number of Public Lamps (Incandescent).
Thousands.	Thousands.	Thousands.	Thousands.	
6,783,474	119,800	6,098,621	6,314,049	24,864

Statement of Residual Products.

Description.	In Store June 30, 1915.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store Dec. 31, 1915.
Coke—tons	24,209	341,047	81,916	229,214	54,126
Breeze—tons	31,797	66,337	28,974	33,464	35,696
Tar—gallons	649,055	5,340,349	5,360,931	4,068	624,405
Ammoniacal liquor—butts	9,546	208,557	208,283	..	9,820

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, £250,104; coke and breeze, £60,808; tar, ammonia, and products, £72,968; and sundry plant and stores, £312,295. The figures this time last year were: Coal, £1,0,204; coke and breeze, £41,700; tar, ammonia, and products, £82,231; and sundry plant and stores, £345,831. A sum of £63,693, co-partnership bonuses and savings, has been deposited with the Company; and the total of the superannuation and guarantee funds is £91,384. The figures last year were £75,220 and £72,750.

ELECTRICITY SUPPLY MEMORANDA.

Breakdowns.

Breakdowns of electricity plant have been unpleasantly frequent of late—some through fires and explosions, and some through plant defects. Only on Dec. 21 reference was made in the "Memoranda" to some recent failures, at Belfast, Dublin, Birmingham, Wolverhampton, Wednesbury, Wigan, and Finchley. But the list has since been extended. Shrewsbury welcomed the New Year by a collapse of the electric current during lighting hours; and in some parts of the town, those who had put their trust in the fidelity of the current were convinced of their folly by a two hours' cessation of supply. A smaller occurrence was that at Leeds two days later, when, through the fusing of an electric cable, some twenty shops were thrown back in their lighting arrangements to pre-gas times. On the 10th ult., Aberystwyth had a turn. A fire took place in the cable trench between the dynamos and switchboard; and it did such a variety of damage that users bemoaned for two days their ill-fortune in having changed from a reliable to an unreliable light. On the 11th, at Wallasey, owing to an accident to one of the turbines at the generating station, there was no current for lighting early in the evening, and only an intermittent tramway service could be run. Later in the evening, the station put forth more effort, and succeeded in supplying all the demands then made upon it for light; but the tramway service, according to the report, had to rest for a couple of hours. These splendid advertisements for gas have caused the "Electrician" to read central station engineers a little homily on the folly of running electricity works with insufficient reserve of plant. It is acknowledged that breakdowns occur more frequently as time goes on; and as recent examples, Halifax, Wallasey, and Wigan are quoted—the first named being an addition to our list. Generating plant is expensive for standby purposes; but it is necessary, in view of the slightness of the barrier against failure where plant is running fully loaded. As our contemporary points out, where generating plant is operating at full load, "the overloading of a set at intervals is impossible;" and a breakdown must occur sooner or later. But several recent breakdowns have been due to causes other than generating plant. Gas has ample protection, both in the character of its manufacturing plant and in its gasholders; and nothing but disturbance of the subsoil in which the distributing system reposes would cause a breakdown between works and consumer, and then it would be but local. We have much in the gas industry for which to be thankful respecting the important factor of reliability in artificial lighting.

Pooling Trucks and Coal Prices.

There are electricity managements that are still in trouble over their coal deliveries and prices. The Marylebone Electricity Department does not like the appearance of the proposal to pool private owners' waggons, and for the same reason that many other buyers of coal object to the scheme. Wisely the Council entered into their coal contracts for electricity generation with contractors and factors who own considerable numbers of waggons, and who are thus able to supply coal with considerable regularity and expedition. If the pooling arrangement is carried out, it is feared that the Council will be placed in a precarious position with reference to the adequacy of supply. Still Marylebone has nothing more of which to complain than many other undertakings; but this does not make any difference to their right of viewing the position with fear and trembling, and of lamenting with others the real injustice of the proposal. Then the Luton Electricity Committee are in discussion with their coal contractors over a matter of interpretation of the Price of Coal Limitation Act; and the Board of Trade have been asked for their opinion. As we understand the position, the Council are contending for 7s. as being the price upon which the standard of 4s. should be placed—the 7s. apparently being the pithead price that they paid for Ibstock coal in 1914. But the colliery people say they are entitled to 13s. 3d., which is only 4s. per ton in excess of the average price per ton received by them during the year ending June 30, 1914. In other words, they submit that they are not restricted by the Price of Coal Limitation Act to (in fixing new prices) the actual price paid by any one purchaser. The Act says: "The price of coal of the same description, sold in similar quantities and under similar conditions affecting the sale at the pit's mouth, at the same coal mine, on the *corresponding date* (or as near thereto as, having regard to the course of business, may be practicable) *in* the twelve months ended the 30th day of June, 1914." Nothing is said about pooling the pithead prices obtained over the year, and dividing the aggregate by the number of tons of coal sold.

The Cooker in the States.

Our esteemed contemporary, the "Electrical Review," calls attention to a report on the subject of electric-cooking conditions in the Western States, which has been presented at the Portland Convention of the N.W. Electric Light and Power Association. The area covered by the report embraces 389,842 domestic electric lighting consumers, of whom 220,042 use gas as fuel, and 2481 electricity; leaving 167,319 employing some other form of fuel. The reporters consider the ways and means of securing a large proportion of the latter as electric cooking consumers, wisely regarding it as unnecessary or undesirable to compete with the gas-cooker. Our contemporary apparently thinks that electricity suppliers cannot adopt such a benevolent attitude in this country, inasmuch as the gas-cooker has so "effectively penetrated into the houses of practically every class of consumer that electric cooking must necessarily be—and even now is, in a small way—in competition with gas cooking here." There is a good deal in the report that is supposed to be of a quite disinterested order, having come from a "gas-electric" man; but as the good old crusted postulations of the electrical cooking people this side (which for years have had currency and small effect) are practically reproduced in the report, the indications are that the gas-electric man has electricity more strongly on the brain than gas. It is considered that in the Western States, electric cooking business can be secured with electricity at 1½d. per unit, because of its "inherent advantages, and the less shrinkage of food." The "inherent advantages" have been pointed out very frequently in these columns—the necessary slowness of operations, the terrible costliness of all boiling operations on the hot-plates, the need for standing guard over the oven-doors so as not to lose from that way any of the precious heat, the nerve-racking and temper-disturbing breakdowns, et cetera (which should be in capital letters). As to the shrinkage, if temperatures are arranged for slow cooking in the gas-oven, there is no necessity for any more evaporation of the water content of the meat, or the drying-up of the solids, than with electric cooking. Shrinkage is all a question of temperature and time. Our contemporary presumes that gas costs 3s. to 4s. per 1000 cubic feet in the Western States, and says that "investigators interested in the gas business believe that electricity at 1d. per unit more nearly equals gas at the prices mentioned." We have never heard of such investigators, unless they are electricians whose "interest" in the gas business is that of purblind rivals. We have heard electricians say it is no use attempting to compete here with gas at a charge for electricity greater than ½d. per unit, when gas is at 2s. 6d. per 1000 cubic feet; and one may be sure they were making the best possible of a bad job. For water heating, the report suggests a rate of 0·4d. to 0·5d. per unit. That is bad for electricity in this country with gas in normal times so much lower in price than the charges "presumed" above for the Western States, which are too low.

Some Further Views.

The "gas-electric" man gives reasons why there are few people cooking with electricity, even where the 1d. per unit rate is in competition with a gas rate of 5s. 3d.!—not 3s. to 4s. The first is that people are accustomed to gas-stoves, water-heaters, and other devices, and do not care about changing from the known to the unknown. Experience, too, circulates. First cost in connection with electric cooking is another drawback. A further reason is the lack of an electric water-heater which is as satisfactory as a gas water-heater. The "Review" thinks the gas-cooking habit in this country is due in great part to the low terms on which the consumer can obtain the necessary apparatus—"terms so low that one suspects future gas consumption bears a proportion of the capital charges." Our contemporary has been studying analyses of gas income and outgoings; and it does not seem to recognize several things—for example, that the figures are spread over all the gas sold for lighting, power, industrial heating, domestic heating, and cooking, and not merely over the gas sold through stoves and other appliances on hire. The gas for heating and cooking is sold at lighting rates, and not at (say) one-fifth to one-tenth part of these. There are several gas concerns which, in view of this, undertake the maintenance not only of stoves on hire, but of stoves privately owned; and they can afford to do it. The figure for maintenance also embraces the charge for depreciation. It must not be forgotten by our competitors that a large proportion of the apparatus that has to be maintained is paid for by the prepayment consumers through the extra charge made for the gas; and the maintenance includes the fittings used for lighting. But to return to the gas-electric man. He asserts that there is greater cleanliness in electric cooking than in gas cooking, and that electricity does not "burn up any of the oxygen in the room." This is the unconscious revival of a piece of old electrical humour. Nature provides plenty of oxygen for her processes of heat provision by combustion; and so long as there is sufficient oxygen for combustion, there is more than enough for persons in the same room, and without any impairing of vitality. It is really marvellous, when one comes to think over the matter electrically, how the stokers in the boiler-room of an electricity station can live, in view of the rate at which the oxygen of the atmosphere is used up! However, the gas-electric man very kindly concludes that the gas business in general will not be hurt by electric cooking, but will be improved as electricity becomes more of a competitor, and with this the authors of the report generously agree. We thank them for this piece of consolation.

The Water-Heating Folly.

The "Ferranti" water-heater has been receiving a little "puff" in the electrical papers; and the results attributed to it are highly entertaining to people accustomed to getting their water heated by quick and cheap means. The heater can be had in the form of an attachment for existing cisterns, or can be supplied with cistern complete. In the latter form, the heater may be used either separately or in league with the existing kitchen boiler. We suggest that, from a consumers' point of view, the latter method would be preferable. The heating element is contained in a chamber having outlets above and below. The heater is mounted on the circulating-pipe connecting the top and bottom of the cistern; and the heated water rises to the top of the cistern, whence it is drawn off. The heater is made in five sizes: 23 gallons, 350 watts per hour; 23 gallons, 500 watts; 34 gallons, 350 watts; 34 gallons, 500 watts; 34 gallons, 700 watts. The dimensions of No. 1 heater over all are 22 in. wide, 29 in. deep, 48 in. high; and of No. 5, 25 in. wide, 32 in. deep, 48 in. high. The net weight of the No. 1 heater with the cistern empty is 220 lbs.; and of the No. 5 heater, 310 lbs. The following table gives particulars of the performance of the water-heater as obtained under actual domestic working conditions:

Size No.	Gallons of Water Raised through 60° Fahr.			
	Every ½-Hour.	Every Hour.	Every 6 Hours.	Every 24 Hours.
1 and 3	0·78	1·56	9·50	38·00
2 and 4	1·10	2·20	13·20	53·00
5	1·50	3·00	18·40	73·50

From this it will be observed that with feed water at 50° Fahr. the No. 1 size heater will give 1·56 gallons of water at 110° Fahr. one hour after switching on, or after all the hot water has been drawn off. Looking carefully at the figures, one may be pardoned for asking if Job is still alive.

Another Tungsten Arc Lamp.

Reference was recently made in the "Memoranda" to the new tungsten lamp developed by the Edison and Swan Company, which, in respect of various characteristics in form, represents an electric incandescent lamp, but in method it operates with an arc. "Electrical Engineering" has lately called attention to another tungsten arc lamp, of American origin, which has been described at a joint meeting of the New York Section of the American Electrochemical and Illuminating Engineering Societies. It is desired that at present the description shall be taken merely as an account of the outcome of scientific research, without giving too much credit to it from the practical standpoint. The statement in our contemporary points out that a study of the light efficiency of an arc from a chemical standpoint shows that there is a certain rather limited class of substances which, when introduced into the arc in small quantities, produce a very great increase in luminosity. Thus the addition of small quantities of cerium or calcium compounds to the carbon arc may increase its efficiency over 300 per cent.; and the addition of titanium (preferably as an oxide) to the magnetic arc similarly produces an increased luminosity without a corresponding increase in energy consumption. But it is a peculiar coincidence that the addition of cerium or calcium to the magnetite arc, or of titanium to the carbon arc, does not result in approximately the same gain in efficiency. Consideration of these facts led to the conception that perhaps an arc could be maintained in a closed vessel, and be supplied with these light-producing elements in the vapour form. The lamp consists essentially of an arc chamber at the centre of which the arc is drawn between two tungsten electrodes about $\frac{3}{16}$ inch in diameter. The electrodes are partly surrounded with a refractory insulator, designed to prevent the arc from moving far from the ends of the electrodes. Tungsten was found to be the most satisfactory electrode material, as it is practically inert, even at a white heat, in the presence of various vapours. As all the liquids employed for supplying the active vapour are hygroscopic, and many of them readily decompose by ordinary moist air, it is necessary to exhaust the air from the lamp, heat the lamp and electrodes while at a low pressure in order to remove the air films, and then admit the liquids without opening the lamp chamber to the air. The appearance of the arc in the lamp is quite different from other commercial arc lamps. Among the vapours experimented with are antimony, tetrachloride, carbon tetrachloride, stannic chloride, titanium tetrachloride, &c. The spectrum of the flame is usually quite different from the arc spectrum, and is characteristic of the elements involved, while the spectrum of the arc independent of the ends of the electrodes (which, of course, give a hot-body spectrum) is usually a band spectrum, and is practically continuous except for a few absorption lines. A curve indicates that a 4-inch arc at 10 amperes requires no more voltage than a 1-inch arc at 2 amperes. In other words, a 10-ampere arc is four times as long; in addition, its intrinsic brilliancy is about five times that of a 2-ampere arc; and, accordingly, the light emitted by a 10-ampere arc under these conditions is twenty times that of a 2-ampere arc. Since the wattage of a 10-ampere arc is only about five times that of the 2-ampere arc, the efficiency is approximately four times that of the latter. Efficiency curves indicate that approximately the point of maximum efficiency of this particular antimony pentachloride lamp is 20 amperes.

Society of British Gas Industries.—The Council announce that the Right. Hon. H. E. Duke, P.C., K.C., M.P., has accepted the presidency of the Society for the ensuing year, in succession to Sir Alfred Keogh, K.C.B.

THE BURDEN OF PITCH.

SOME PROMISE OF RELIEF.

By Thomas Glover, of Norwich.

Proprietors of coke-ovens and gas engineers—with the approval of their directors and municipal committees—are all endeavouring to adjust methods of manufacture in such a way as to increase the yield of benzol and toluol; but huge stocks of pitch at the present time are having a retarding effect on the production of these essentials for the manufacture of high explosives. To some gas engineers and all tar distillers the subject of pitch has become a real burden; and if new outlets can be found, much relief will be experienced and great benefits may result.

The gas industry of this country uses about 15,000,000 tons of coal per annum, 5 per cent. by weight of which, by the processes of carbonization and tar distillation, is converted into pitch. We get, therefore, a figure of 750,000 tons of pitch produced by the gas industry, to which we may add the quantity from the newer form of coke-ovens; and it is obvious that the total yearly production of pitch must exceed 1,000,000 tons. In pre-war days, the great bulk of this output was taken by Belgium and France for the manufacture of briquettes; and these conditions will doubtless obtain again when peace returns to Europe. The sudden closing of this market has brought us face to face with a serious situation.

British-Made Briquettes.

Now there are three ways in which the pitch position can be met. In the first place, there is the British-made briquette, which is of quite different shape and size from our old-fashioned notions of a briquette. It is so proportioned that it can be put on the domestic fire just like handy cobbles of coal, and produces quite a pleasant and lasting fire. Briquettes made to the old pattern form a dull, slow-burning, uninteresting mass; but briquettes such as I have in mind give, for a little time, a cheerful blaze, and when the pitch and creosote are exhausted throw out a fine radiant heat, like that of glowing coal. Briquettes of this kind are now being made at some gas-works; and I speak from personal experience when I say that they afford a highly satisfactory and clean looking fire.

It is unfortunate that in the manufacture of briquettes only 10 per cent. of pitch is required, mixed with 90 per cent. of fine coke breeze or coal slack. If the position was reversed, and 90 per cent. of pitch was needed, the proposition would be an attractive one from the point of view of absorbing pitch. It is, however, interesting to know that coke breeze can be employed in their manufacture; and it is stated that washed pan breeze, with 10 per cent. of pitch and some tar oils, will make exceedingly good briquettes. With the high price of coal now prevailing, it would appear to be of increasing importance to convert the pitch into some such convenient form of fuel as to enable its heat value to be realized.

The manufacture and sale of briquettes may provide a new sphere of usefulness and a source of revenue for gas undertakings; and by taking up the manufacture we should be turning to good account some portion of the pitch production.

As a Road Binder.

Another outlet for pitch may be found in its extended use as a road binder. It cannot be too strongly impressed on road authorities that pitch products will make thoroughly satisfactory bituminous binders for roads. One can only earnestly hope it is not true, as reported, that the money which motorists have contributed—by taxes on petrol, &c.—for the improvement and proper maintenance of the roads, is, at the present time, being disbursed by the Government for other purposes. It will be a matter adversely affecting the pitch position if this money is not to be available for the purpose for which it was raised. The road crusts in this country have been built-up during the last few years by surface tarring, and are in many cases extremely satisfactory; but they are only thin. They have been improved by the yearly application of tar and chippings; but if they are to be neglected for one year, this thin road crust will break through, and there is no road so unsatisfactory as one which is partly worn out and partly tarred. Those who have motored over such roads in various parts of the country are aware that this is the case. And there is another aspect. People who live in districts where the roads are made up with broken flintstone have found that they cannot travel on certain roads without being let-down; and when they get home and examine their spare wheels, they pull out sharp pieces of flint, which might have been specially designed to puncture tyres. It is scandalous that in these days roads should be patched with unrolled flint stones, or, indeed, that roads should be patched or re-surfaced with anything but tarred stone or stone grouted with a pitch binder.

Here is an outlet for pitch, if the road authorities will only do their duty, and see that a proper quantity is put on the roads.

Pitch for Gas Making.

But there is another direction in which we can help ourselves. It was originally suggested, I think, by the introduction into this country of pitch resulting from the distillation of petroleum oil. The hydrocarbons contained in this pitch are, for the most part, of the paraffin series; and it has proved a very rich material for gas-making purposes.

Bearing in mind what has just been mentioned, and reflecting on this great burden of many thousands of tons of pitch, representing a large amount of dead-money to the gas and tar industries, it naturally occurred to me—as it has done to others—that if this paraffin pitch has been used for gas making with good results, what the effect would be of carbonizing a suitable proportion of coal-tar pitch mixed with coal. I therefore tried some experiments.

It will be found that, without any trouble ensuing, 5 per cent. of the pitch previously disintegrated, can be mixed with the coal as it is fed into the breaker or elevator, and passed into the hoppers. If the pitch were carbonized separately, a light, porous, honeycombed coke would be produced, as near pure carbon as possible, though not in the crystalline form of diamonds. I do not propose to make this pure pitch coke, though it might be useful for some very delicate metallurgical purposes. Satisfactory coke has resulted from tests of 5 per cent. of disintegrated pitch mixed with Yorkshire washed nuts. Another experiment with 10 per cent. of pitch mixed with coal nuts resulted in coke varying so little from the 5 per cent. mixture that it was hardly possible to distinguish one from the other. A trial was then made with a 20 per cent. mixture; and the coke was of rather more compact character. It was not honeycombed; the ingredients being so thoroughly mixed and fused in the process of carbonization that it was impossible to detect that pitch had been used. If tested for ash, of course, a reduction would be noticed, because pitch coke contains an extremely small quantity of ash.

RESULTS OF EXPERIMENTS.

Unfortunately, with a depleted staff, experiments are difficult to carry out satisfactorily; and it is impracticable to confirm the results by repeating them as one would like to do. I am, however, able to give particulars of a trial working with a 5 per cent. addition of pitch to the coal. On a previous occasion, we worked 24 hours with 5 per cent. of coal deducted and 5 per cent. of pitch added, and for a similar period with 10 per cent. of the coal displaced with pitch. In the latter experiment, a little trouble was experienced with the upper parts of the ascension-pipes and by the thickening of the tar in the hydraulics. With 15 per cent., we got blocked pipes; but with 5 per cent. one can go on indefinitely without trouble, and it is being done at the Norwich Gas-Works from day to day. We are using up our own production, so that the burden of pitch does not exist for us.

Now, as to the results of the trial working at a small town gas-works—fitted as a test works—to which allusion has already been made. The report I have received states that on the first day there was normal working with charges of 2½ cwt. of coal per retort, and on the following day a similar charge of coal with the addition of 5 per cent., or 14 lbs., of pitch per charge. The heats were exceptionally good, and the working was with a fresh truck of coal just received. No trouble was experienced with the ascension-pipes, though a slight coating of lampblack was noticed on the mouthpieces and lids when the pitch was in use.

The gas results showed an additional make of 600 cubic feet from 126 lbs. of pitch, which is equal to 10,666 cubic feet per ton of pitch. There were 8½ lbs. more coke obtained from the charge; and this is equivalent to 12·14 cwt. per ton of pitch. All possible precautions were taken to ensure the coke being thoroughly dry before weighing; for it will be understood that even 1 lb. of water would make a vast difference to the results. From figures obtained in the laboratory, however, about 10 cwt. of coke per ton of pitch is the quantity expected.

The illuminating and calorific values were practically the same in each case; the gas being of good quality throughout. These particulars are from a brief report by the chemist in charge of the test works, who then goes on to give figures which show that he was making at the time 12,035 cubic feet per ton from the coal alone; and with the coal and pitch, of course, the make went down slightly, to 11,970 cubic feet.

From what has been said here, I feel we are justified in believing that our pitch will make gas. I am, of course, speaking of Norwich pitch. It is impossible for me to say what other pitch will do. Some people say that pitch derived from tar produced at certain works is inert, and contains an undue percentage of free carbon. But our results are sufficient to encourage managers of gas undertakings to relieve the position by each taking his own equivalent of pitch from the tar distiller, who has been saying, "I cannot pay for your tar, because I cannot sell the pitch."

If tar is being sold on the sliding-scale based on the products it contains and their market values, a works taking its proportion of pitch will get a fair price for the tar. If tar distillers agree to sell at 15s. per ton of pitch, I think the equivalent in other products will be realized, and a reasonable price obtained for the tar. If, however, the price be fixed at 20s. to 30s. per ton, gas undertakings purchasing pitch for carbonization will realize its value partly in the improved price obtained for the tar, and partly in the value of gas and other products. Thus the whole transaction will become automatic, and the great burden of pitch will be lifted.

THE COKE-WORKS POINT OF VIEW.

So far, I have only discussed the matter from the gas engineer's and tar distiller's point of view. The coke-works manager, however, may take an important part in this beneficial movement; and probably greater direct benefits accrue in the case of coke-oven products and in the financial results of working, than in those of a gas-works.

The compactness and metallic texture of the coke from ovens is principally due to the carbonized tarry matter and the prolonged period of exposure to carbonizing temperature to which the heavy charges are subjected. Lean coals, even when compressed by stamping, produce less satisfactory coke than coals rich in resinous and hydrocarbonaceous matter. A suitable percentage of disintegrated pitch added to such coals would produce a denser, purer, and more valuable metallurgical coke. It may be remembered by some who by chance read these notes that a coking process was in use at one of the large iron-works in the Black Country for some years, for producing from the non-coking South Staffordshire coals coke suitable for use in blast-furnaces. The South Staffordshire coals are particularly deficient in resinous matter; but this defect was compensated for by the addition of ordinary coal-tar pitch, with, I believe, satisfactory results.

There is every reason to believe that pitch could be used with advantage in large quantities at the coke-ovens. An experiment already made in the North-East Coalfield gives one confidence in recommending the matter to the serious consideration of coke-oven managers.

EXPERIMENTAL CARBONIZATION AT A GAS-WORKS.

The following are the figures relating to the experimental carbonization of coal and coal and pitch at the experimental works to which I have referred:

—	Normal Working	5 Per Cent. Pitch.
Gas made	13,540 cub. ft.	14,140 cub. ft.
Coal used	22½ cwt.	22½ cwt.
Pitch used	—	1⅛ cwt.
Gas made per ton of coal	12,035 cub. ft.	—
,, ,, coal and pitch	—	11,970 cub. ft.

Additional gas made by 1⅛ cwt. of pitch . . . . 600 cubic feet.
Equivalent to 10,666 cubic feet per ton of pitch.

Weight of coke from charge	192½ lbs. Equal to 13·75 cwt. per ton of coal.	201 lbs. Equal to 13·67 cwt. per ton of coal and pitch.

14 lbs. of pitch yield 8½ lbs. of coke, or 1 ton of pitch yields 12·14 cwt. of coke.

Calorific Values—B.Th.U. Net.

Sighest observed	595·83	588·03
Lowest observed	541·89	545·85
Hample collected over six hours	565·85	561·18

Illuminating Power.—Candles.

Highest observed	21·5	22
Lowest observed	17	17
Sample collected over six hours	18·25	18·25

Benzene and Toluene in Gas per 12,000 Cubic Feet.

Crude naphtha to 145° C.	2·64 galls.	2·69 galls.
,, ,, 145 to 170° C.	0·117 galls.	0·124 galls.
Benzene	17·33 lbs.	17·68 lbs.
Toluene	2·96 lbs.	2·82 lbs.

Proximate Analysis of Pitch.

Volatile matter	51·2 per cent.	Ash in pitch	1·1 per cent.
Coke	48·8 ,,	Ash in pitch coke	2·25 ,,

Sulphur in pitch coke . . . 0·178 per cent.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

A Meeting of members of the Association—the busy time of the year and other unpropitious circumstances were responsible for a smaller attendance than usual—was held on Friday evening at the Westminster Technical Institute, Vincent Square, S.W., when a paper, which was illustrated by lantern slides, was read by Mr. E. Stroud, of Holophane Limited. The paper was on the subject of "Modern Illumination as Applied to Gas Lighting"; and the main portions of it, with some notes of the discussion to which it gave rise, will be found on pp. 260-62 of this issue.

At the opening of the proceedings, the President (Mr. S. B. Chandler, of the South Suburban Gas Company) remarked that it had been thought proper that a letter should be addressed, on behalf of the Association, to Mr. G. M. Gill congratulating him on his appointment as Chief Engineer of the South Metropolitan Gas Company. In reply, Mr. Gill had expressed his thanks to the Council and members for their good wishes, and had stated that anything he could at any time do for the Association would be a pleasure to him.

SULPHATE OF AMMONIA SUPPLIES AND EXPORT LICENCES.

Suspension of Licences—Farmers Urged to Buy Early and Largely.

Last week the Board of Agriculture issued the following statement regarding sulphate of ammonia supplies and exports:

> In view of the uncertainty as to the sufficiency of the supplies of sulphate of ammonia to meet the home demands during the next few months, it has been decided, on the recommendation of the Fertilizers Committee, with the approval of the President of the Board of Agriculture and Fisheries, and the President of the Board of Trade, to suspend for the present the issue of licences for the export of sulphate of ammonia.
>
> Under normal conditions, it is well known that the production of sulphate of ammonia considerably exceeds home requirements, but Lord Selborne confidently hopes that farmers will this year greatly increase their demands for fertilizers of all descriptions so as to stimulate, so far as practicable, the production from the land, and thus reduce the importation of foodstuffs. This stimulus is the more necessary to counterbalance in some degree the hindrances to production arising from shortage of labour and other causes.
>
> Lord Selborne therefore appeals to farmers generally to justify his belief in their enterprise and patriotism by availing themselves of the opportunity now provided to secure plentiful supplies of fertilizers. Farmers are especially urged to place their orders for sulphate of ammonia at once, so as to enable the expected increased demand to be met without undue delay or difficulty.

LETTER FROM THE SULPHATE OF AMMONIA ASSOCIATION.

In connection with a letter addressed by the Board of Agriculture to sulphate of ammonia makers—it also touches the questions treated upon in the foregoing notification—the Sulphate of Ammonia Association have addressed the following letter (signed by the Chairman, Mr. D. Milne Watson), to producers:

Available Supplies and Licences.

You will have received a long letter from the Board of Agriculture with reference to the present position; and, as the Board refer to us, we think it desirable to make a few comments.

We may say that we realized some three months ago that the present difficulty was likely to arise; and we then approached the Government and asked them to take steps to obtain information relative to the production and probable consumption of this article in the spring, together with returns from export merchants showing what quantities had already been sold to foreign countries. Our object was to enable the Government to make as accurate a forecast as possible of requirements and supplies, and thus determine in advance what quantity would be available for export each month. Our idea was that export licences should then be granted at the beginning of each month for the estimated surplus, and that further licences should be issued towards the end of the month if the surplus turned out to be greater than was anticipated. This plan would have enabled the whole question to be dealt with in a scientific and businesslike manner; and as the Government has in its possession information regarding the quantities already sold to overseas countries, it would have been perfectly easy to allocate the export licences granted in proportion to the purchases made by each country, giving such preference to our Allies as was deemed necessary.

We regret that, in spite of the fact that they have all the information, the Government apparently do not intend to make such use of it as we have above indicated. They apparently assume that the normal home demand will be nearly trebled, and are only granting at present applications for export licences made before a certain date, although this will necessarily involve injustice to some of our overseas customers. This result is disappointing; but we think we have succeeded in convincing all departments concerned that it is absolutely necessary that manufacturers of sulphate of ammonia should obtain a regular outlet for their production, so that, if the home demand proves insufficient to keep the works clear, further licences for export will undoubtedly be granted.

We notice that the Board of Agriculture ask you to make returns on the 1st and 15th of each month, showing the position of your stocks. In view of the very great difficulty in shipping sulphate of ammonia at the present time, it is desirable that licences should be available before the storage accommodation at the works is absolutely exhausted, for an interval of probably at least fourteen days will elapse between the issuing of the licence and the possibility of shipping. We would therefore recommend you to advise the Board of Agriculture immediately there is any danger of your works becoming overstocked.

Price Agreement and Sulphuric Acid.

There is another matter on which we wish to say a few words. When we agreed to sell to farmers during November-December at £14 10s., Mr. Acland, of the Board of Agriculture, distinctly informed us, at one of the meetings of our Committee, that the Government would not interfere with the price of sulphate of ammonia in the spring. In spite of that, and in spite of the fact that we of our own accord suggested to manufacturers at the end of December to limit the price of sulphate of ammonia for home use for the spring, the Board of Agriculture have endeavoured by every possible means to induce us to agree to a still lower price. We so far yielded to their representations as to suggest to manufacturers to limit the home price to a maximum of £16 15s., in bags at works, net cash; but we made it clear to the Board that this offer was conditional on the Government taking the necessary steps to provide sulphuric acid at a reasonable price.

We understand that a Committee was appointed by the Ministry of Munitions to deal with the acid question, and that this Committee has now reported. But we gather that the Government still shrink from taking the necessary steps to control acid manufacturers, and that nothing further will be done unless overwhelming pressure is brought to bear on the Government. We have sufficient first-hand evidence in our possession to show that acid manufacturers are taking advantage of the shortage of supplies in a scandalous manner. We therefore advise you, in case you are not able to obtain supplies at a reasonable price, to write to the Ministry of Munitions, Storey's Gate, Westminster, enclosing a copy of your letter to the Rt. Hon. F. D. Acland, M.P., Board of Agriculture, No. 3, St. James's Square, S.W., requesting the Government effectively to reduce and limit the price of acid.

Stimulating Local Demand.

Finally, we notice that the Board of Agriculture ask you to state what steps you have taken to stimulate the use of sulphate of ammonia by farmers. Those who are members of this Association can answer that question sufficiently by simply stating that fact; and we would suggest to those who are not members that they can most easily answer the question by joining the Association immediately.

We may say that within the last fortnight we have distributed some 400,000 leaflets to farmers, and that we are conducting a most energetic campaign, and spending a large sum of money on advertising in the Press. Further, we are sparing no effort to put country dealers and other users into touch with suppliers, and generally to facilitate trade in our product.

PUBLICITY AND EDUCATIONAL WORK OF THE ASSOCIATION.

The information conveyed in the last two paragraphs of the foregoing letter is important. It shows that the Association are actively at work not only trying to enlarge the home demand for sulphate of ammonia, but to do what the Government are anxious should be done—help to intensify the cultivation and production of foodstuffs. The publicity work of the Association covers a large field—in fact, the functions of the organization in this respect are exercised generously yet judiciously and systematically. We have some specimens of excellent block advertisements the truly rural landscapes presented in which show in most commanding manner the values of sulphate of ammonia. In one of the advertisements, too, the sun and a couple of gasholders form the background to a view in which the representation of the sulphate of ammonia raised crops must make every farmer wish that his own soil was as productive of wealth. These advertisements appear in the "Journal of the Board of Agriculture," "Agricultural Gazette," "Country Gentlemen's Estate Book," "Country Life," "Farmer and Stockbreeder," "Fertiliser and Feeding Stuffs Press," "Farm Life," and "Field." Advertising in other agricultural papers is also to be undertaken shortly.

In regard to literature, too, the Association are very successful. They have brought out in quite tasteful form a new and revised edition of their pamphlet "The Manure Richest in Nitrogen." The printing on the cover is symbolic of a golden harvest and golden returns. Another illustrated pamphlet entitled "Luxurious Growth" is now in the press. Some 400,000 of a circular "To Farmers" were printed, of which about 310,000 have been distributed in lots of 100 copies among some 3100 manure dealers throughout the United Kingdom, with the request that they will circulate them among their customers. About 60,000 have been sent to sulphate of ammonia manufacturers throughout the United Kingdom for local distribution among farmers, and some 10,000 are being distributed from the head office.

As to prize competitions, money prizes amounting to £250 are being offered for the best crops of mangels, swedes, potatoes, and ox cabbage grown with the aid of sulphate of ammonia.

Field experiments are being continued throughout the United Kingdom, under the supervision of the Association's eleven District Supervisors, but on a restricted scale, owing to the reluctance of many farmers to undertake the experiments in consequence of the shortage of labour and other causes due to the war. Mr. Leighton (who is very active in the propaganda branch) has instructed the Supervisors to devote as much time as possible during the next few months to ascertaining manure dealers' spring requirements of sulphate of ammonia, and to assist them in every way in obtaining supplies locally. This information shows that during war time, as in peace time, the Committee of the Sulphate of Ammonia Association are looking after every opportunity for enlarging demand.

"ESCAPES" OF COAL GAS, AND THEIR EFFECT AS REGARDS INJURY TO HEALTH.

A prominent feature in the case of *Lockyear v. Kingsclere Guardians*, which was taken at the Berkshire Winter Assizes on Jan. 13 and 14 [*ante*, p. 157], was the conflicting nature of the evidence bearing on the material facts, in respect to which more than one of the witnesses decidedly contradicted their own statements. The explanation may be that the incidents on which the claim of the plaintiff was based were passed over as ordinary occurrences of no special importance at the time, and that they happened in November, 1913—fourteen months ago. Probably nothing in the way of evidence or cross-examination, in connection with them, was then anticipated. All this is very interesting to those who care to follow the intricacies of legal proceedings, but has no special association with the gas industry.

So much cannot be said, however, in respect of the evidence tendered by Professor H. Wilson Hake, of the Westminster Hospital Medical School, as to the effect of an "escape" of gas in relation to the health of the occupants of a room in which it occurs, especially in view of the fact that gross exaggeration and misrepresentation are prevalent on the very important matter of the "wholesomeness," or otherwise, of a free use of gas in the home or workshop. Our readers have frequently heard (from their customers) of assertions to the effect that where there are gas-pipes there is also leakage, and that where there is leakage there must, of necessity, be injury to health. Or admitting that, by unusual good luck, the pipes and fittings may be perfectly sound, the consumers' attention is directed to the length of pipe between the tap and burner in an ordinary bracket or pendant, which may be (say) 12 inches. When the gas is shut off, after use, it is said that this run of pipe is full of gas, all of which may escape into the atmosphere by transpiration from the nipple of the burner, as proved by the fact that if the gas is turned on after some hours, a quantity of air is displaced before the gas can be ignited. The material facts that the quantity of gas concerned is infinitesimal, and that the specific gravity of gas, as compared with air, ensures the rapid progress of escaping gas towards the ceiling, are evaded or glossed over; while at the same time the poisonous qualities of carbon monoxide are rushed for all they are worth. Working on these lines, an ingenious canvasser can construct a plausible argument for bridging-over the objection due to the difference in cost as between gas and electricity.

The most important question in connection with poisons of any kind is the quantity required, not necessarily to cause death or dangerous symptoms, but to occasion unpleasantness or discomfort, perhaps of only a temporary character. If the poison is in the form of a gas, Nature provides a most effective protection, in respect to gases that affect the sense of smell, which includes all kinds of "town" gas. Many persons, in the course of their daily employment or otherwise, habitually imbibe poisons of various kinds, but in quantities below the limit above indicated, without the slightest apparent ill-effect; and the specially notable feature of Professor Hake's evidence is that it deals with the question of the limit of safety. Our interest is enhanced by the fact that he avoids scientific language or formula, and presents his deduction in a common-sense form, readily understandable.

In the course of a description of the room in which the poisoning was alleged to have taken place, the evidence showed that it was a fair-sized apartment of some 3000 cubic feet content, having two doors on opposite sides of the room (both in regular and frequent use), two windows that could be open if desired, and a fire-grate with chimney, in which a fire was regularly maintained, when necessary, all of which would tend to ensure excellent ventilation. The only gas-fitting in the room was a single pendant light, with cup-and-ball joint, and a flat-flame burner. The supply consisted of "straight" coal gas, in which the only active poisonous ingredient, as generally agreed among toxicologists, is carbon monoxide, which would, in these circumstances, be present in the gas to the extent of about 6 per cent. Professor Haldane has shown that an atmosphere containing one part in 2000 of carbon monoxide might occasion toxic symptoms, that with one part in 500 the symptoms would be urgent, and that about one part in 100 must be regarded as fatal.

Working on these simple data, Professor Hake proceeded to consider the effect of an imaginary escape of gas in the room. A leakage to the extent of 1·5 cubic feet would be the minimum quantity required to produce an atmosphere containing one part of carbon monoxide in 2000; and some considerable time would elapse before the gas could by any possibility be uniformly diffused, since coal gas is lighter than air, and with fair ventilation much of it would be carried away by draught. To obtain an atmosphere of one part in 500, at least 6 cubic feet of gas must escape. A leakage to the extent of only 1·5 cubic feet would produce an odour extremely perceptible to any individual accustomed to the use of gas. An ordinary flat-flame burner, consuming 5 cubic feet of gas per hour, would need to be turned on full (unlit) for 18 minutes to produce such a result. A similar burner would have to be turned full on for 72 minutes before 6 cubic feet of gas could escape. A leakage to anything like this quantity would produce such a pronounced odour as to cause great alarm, on account of the general fear of explosion. The odour of coal gas is perceptible when it is present in the air to the extent of only one part in 10,000; and in the course of a long experience in the use of gas apparatus, he had frequently noticed the very perceptible odour produced when the gas was turned on only for a few seconds. Under the conditions he had named, it would be impossible to obtain a toxic atmosphere by admixture of coal gas, without warning of a very obvious character to persons who were awake and using the room; and most people, in the event of an escape of gas, would take some action towards investigation and location of the same, or would direct attention to it and call some one into the room to verify it. As regards ordinary cases of persons being affected by coal gas, it usually happens that the victims were occupying a bedroom, and asleep, during the period when, by reason of some escape of gas, the atmosphere became contaminated in a continuously increasing degree. A person not asleep may feel the gradual approach of lassitude, semi unconsciousness, or other unfamiliar symptoms, in time to rescue himself. The plaintiff, being on night duty, and obviously not asleep or undressed, would not be occupying the room continuously, but be moving in and out in the course of the night.

After remarking on some of the symptoms described by the plaintiff, Professor Hake stated that in severe cases of poisoning by carbon monoxide or coal gas, the onset of symptoms is somewhat rapid. There is no pain in the first instance, but there may be a preliminary period of excitation akin to intoxication, and often of a pleasurable character, followed by a sense of heaviness in the head, dizziness, noises in the ears, accelerated cardiac and respiratory movements, oppression on the chest, and consequently vomiting. Along with these symptoms, muscular weakness ensues, followed by drowsiness, coma, or death, if the patient is not rapidly removed from the toxic atmosphere and has not undergone too long an exposure. Treatment by means of oxygen, or artificial respiration, or stimulants, is usually resorted to. If the patient recovers, after acute poisoning, among the after-effects may be specially noted severe headache, occasional palpitations, occasional seizures rather in the form of an epileptiform fit than of fainting, and sometimes temporary loss of power in the legs. These after-effects may occur every few days, and they sometimes continue for weeks at intervals; but, as a general rule, when recovery has occurred they pass away and leave the patient normal, nor do they seriously interfere with ordinary occupation.

Professor Hake also referred to a report by the late Sir Clement Le Neve Foster, F.R.S., one of His Majesty's Inspectors of Mines, on the effect of carbon monoxide in connection with an underground fire at Snaefell Mine, Isle of Man, in 1897, in which the effect upon himself and others of acute poisoning by the vitiated atmosphere is minutely described. In this accident, twenty miners were overcome and died from the effects of carbon monoxide poisoning, in an atmosphere shown by the analysis of Dr. Haldane to contain slightly over 1 per cent. of this gas. Sir Clement Le Neve Foster, his Assistant, Mr. Williams, and about four others, while engaged in rescue work and investigation of the accident, were suddenly overcome by the poisoned air and rendered unconscious. They had to be hauled up to the surface from a depth of 100 feet. They suffered no pain at the time of being overcome, but began to feel ill shortly after, and were at first dazed and semi-conscious. The after-effects were such as those already mentioned; but although they were rescued from certain death, they all recovered, and apparently were not seriously prevented from continuing their various activities.

Having referred to the symptoms of carbon monoxide poisoning at some length, in order to emphasize their marked character, Professor Hake observed that none of these were specifically put forward in the plaintiff's claim, and that it was clearly evidenced that she did not and could not have suffered from acute poisoning by inhalation of coal gas. He also dealt with chronic poisoning by coal gas, or carbon monoxide, as brought about by long and continued exposure to an atmosphere containing smaller proportions of these gases; and he showed that the plaintiff's symptoms were in no way compatible with this form of poisoning.

There is one point in connection with Professor Hake's evidence to which attention should be directed. The authorities on which he relies deal with neat carbon monoxide and not with a coal gas containing 6 per cent. of this compound; and there must be a marked distinction, as regards toxic effect, between the two. In his calculations, he treats the coal gas as being equivalent to pure carbon monoxide. For instance, he speaks of 1·5 cubic feet of gas being required to give an atmosphere containing one part in 2000 of carbon monoxide, whereas it is evident that sixteen times this quantity would be necessary to secure such a result. As compared with pure carbon monoxide, there must be a very substantial margin in favour of a coal gas containing only 6 per cent. of this compound; the remainder being composed of comparatively innocuous gases. The evidence is therefore largely on the safe side, not only in respect to coal gas, but also to carburetted water gas in any proportion. Whether the gas supply is "straight" or "mixed," it is conclusively proved that, in the absence of extraordinary or criminal negligence, no risk or danger can by any possibility attend the use of town gas, by reason of unpreventable or non-evident escapes in the consumer's supply pipes or fittings.

German Iron Coinage and Prepayment Meters.

A report from the Central Gas Publicity Bureau of Berlin, in the "Journal für Gasbeleuchtung" of the 15th ult., points out that the German Imperial Bank has taken great care that the small iron coins which have been issued to replace the nickel coins that have been called in on account of the nickel being required for munition manufacture, shall be serviceable in prepayment meters designed for the use of the nickel coins. It would appear that five pfennige pieces [about ½d.] of iron have been longer in use than iron ten pfennige pieces. The iron coins are Sherardized to protect them from rusting. The five pfennige iron pieces are of the same weight as the nickel coins which they replace, but are rather thicker and have milled edges. The ten pfennige iron pieces, on the other hand, are exactly the same size as the former nickel coins of the same value, and, like them, have smooth edges. The Bureau states that it has proved by trial that the new coins operate quite satisfactorily all the types of ten-pfennige prepayment meters in use, and that the users of these meters (which number over 1¼ millions in Germany) will find that they can continue to obtain supplies of gas with the same facility as hitherto, notwithstanding the change of coinage.

THE UTILIZATION OF ENERGY FROM COAL.

By Professor William A. Bone, D.Sc., Ph.D., F.R.S.

The second of a series of three lectures on the above subject, by Dr. William A. Bone, F.R.S., Professor of Chemical Technology at the Imperial College of Science and Technology, was delivered at the Royal Institution last Thursday. The first lecture appeared in the "Journal" last week (pp. 206-208), and the third, and final, one will be delivered next Thursday.

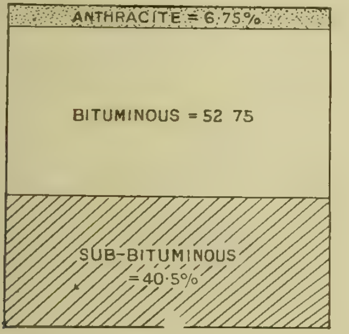
Fuel Economy from a National Standpoint.

The national aspects of fuel economy may be considered from two somewhat different standpoints—namely: (1) In view of the economic situation created by the war, and the necessity of enforcing a policy of national economy in the utilization of essential commodities as the best means of paying a colossal war debt; and (2) in view of the interests of that remoter, but nevertheless not far distant, future, when our coal supplies will be restricted by approaching exhaustion.

It can hardly be questioned that the chief material basis of the great industrial and commercial expansion of this country during the past century has been our abundant supplies of easily obtainable coal, which, until quite recent years, have given us a position of great advantage over all other countries. It is also equally true that we can no longer claim any advantage in this respect over our two nearest competitors, and that our whole economic future is dependent on our ability to maintain abundant supplies of relatively cheap fuel, which, in turn, is limited by the probable duration of our easily workable coal seams in relation to present and future demands. In order that we may the more clearly apprehend the grave national importance of the coal question at this crisis in our history, I will attempt a brief statistical survey of the world's coal resources, and the relation of the principal coal-producing countries thereto.

The World's Coal Resources.

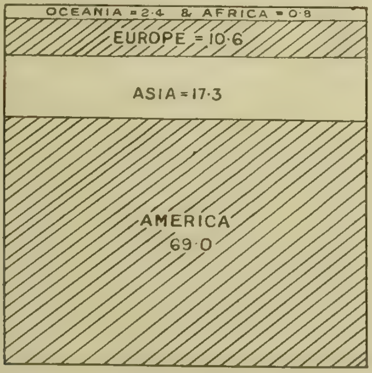
According to an exhaustive and very illuminating report upon the World's Coal Resources issued by the International Geological Congress in 1913, the total probable and possible reserves of coal of all kinds (including anthracites, bituminous coals, and lignites) available within 6000 feet of the earth's surface, are estimated to be 7,397,553 million metric tons; or, approximately, 6000 times the present total annual consumption. Therefore, the world as a whole need have no fear of any speedy exhaustion of its coal supplies.



World's Estimated Reserves of Coal, 1913, 7,397,553 Million Tons.

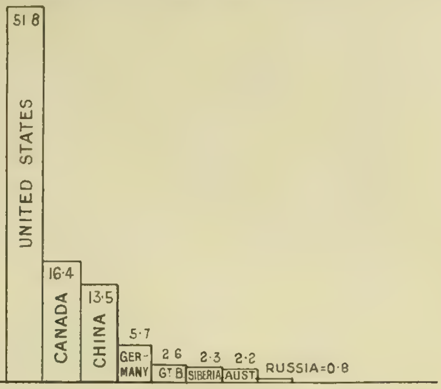
Of the estimated total reserves, 6·75 per cent. are anthracites (mainly located in China), 52·75 per cent. are bituminous coals, 40·5 per cent. belong to the less valuable sub-bituminous class, which includes all the lignites and tertiary brown coals.

A survey of the geographical distribution of the estimated reserves should cause the belligerent powers of Europe to recognize the folly of the present wholesale destruction of human life and accumulated wealth, for no less than 69 per cent. of the total are located in America (almost wholly North America), 17·3 per cent. in Asia, 10·6 per cent. in Europe, 2·4 per cent. in Oceania, and only 0·8 per cent. in Africa. It is a significant fact that the two tropical Continents of South America and Africa are practically destitute of coalfields of any economic importance. The future wealthy republics of South America must continue, as heretofore, to import coal, machinery, and heavy manufactured goods, in exchange for agricultural produce and raw materials.



Percentages of World's Total Coal Reserves.

Pursuing the matter a little further, we find that of the total estimated reserves, 51·8 per cent. are located in the United States, 16·4 per cent. in Canada, 13·5 per cent. in China, 5·7 per cent. in Germany, 2·6 per cent. in Great Britain, 2·4 per cent. in Siberia, 2·2 per cent. in Australia, and only 0·8 per cent. in Russia. I think that China's resources have probably been considerably under-estimated; and I should be inclined to place China second to the United States. Otherwise the relative positions of the remaining countries are probably substantially as stated. It is, therefore, not difficult to foresee where, in the not far distant future, when Europe's coal supplies approach exhaustion, the world's chief centres of manufacturing industry will be located. By that time the Chinaman, with his simpler standard of living and infinite capacity for patience and industry, will have learnt all he needs about western technical methods to make him the most formidable competitor of the white races; while the surplus population of Europe, or as much of it as is economically worth preserving, will have migrated to North America, where it is to be hoped, for the sake of freedom and humanity, the Anglo-Saxon race will always continue as predominant as it is to-day.



Percentages of World's Total Coal Reserves.

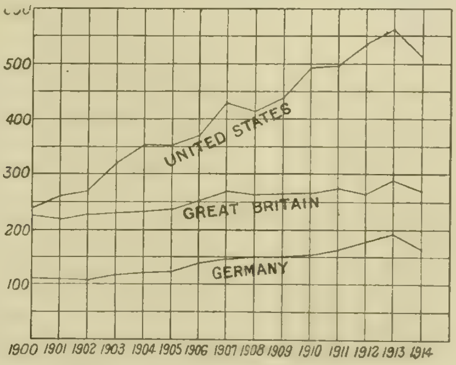
The world's demands for coal are increasing rapidly year by year. Thus, in 1903, they were 800,000,000 tons; five years later—that is, in 1908—they had increased to about 1,000,000,000 tons; and by the year 1913 they amounted to no less than 1,250,000,000 tons. This represents a continuous increase over a ten-years period, at a "compound interest" rate, of nearly 5 per cent. per annum, which rate is hardly likely to diminish after the conclusion of the present war.

World's Output of Coals—Millions of Tons.

—	1903.	Per Cent.		1908.	Per Cent.		1913.	Per Cent.	
United States . .	319·5	40·0	83·4	415·8	41·5	82·3	562·6	45·0	83·3
Great Britain . .	230·4	28·8		261·5	26·0		287·4	23·0	
Germany	116·6	14·6		148·6	14·8		191·5	15·3	
France	34·3	4·3		36·8	3·7		40·1	3·2	
Belgium	23·8	3·0		23·7	2·3		22·8	1·8	
Russia	16·5	2·0		29·4	2·9		28·8	2·3	
British Possessions .	26·5	3·3		42·0	4·2		50·0	4 0	
All Other Countries.	32·4	4·0		43·2	4·3		66·8	5·4	
Total . . .	800·0	100·0		1000·0	100·0		1250·0	100·0	

Inasmuch as the world's demands have, during the period in question, been principally supplied by three countries—namely, the United States, Great Britain, and Germany—which between them have annually raised practically 83 per cent. of the coal consumed in the world, we may now concentrate our attention upon the statistics for these countries.

In the next diagram are plotted the annual outputs of anthracite and bituminous coals (lignite and brown coals have been excluded



Coal Production, in Millions of Tons, of the United States, Great Britain, and Germany—1900 to 1914.

because of their relative unimportance, although Germany annually raises large quantities of brown coal for consumption) of the three countries for each of the fifteen years 1900 to 1914 inclusive. Excluding the outputs for the last of these years, all of which showed a sharp decline owing to industrial dislocation subsequent upon the outbreak of the war, and the year 1912 for the British output, which was affected by the great coal strike, the outputs of all three countries, and particularly those of the United States and Germany, showed a progressive increase over the whole period.

If, now, the average annual outputs for each of the three successive quinquennial periods included in the fifteen years survey be taken, the following figures are obtained, which indicate that the output of the United States is increasing annually at a "compound interest" rate of 6 per cent., that of Germany at a compound rate of 4 per cent,, while the British output is increasing at a compound rate of only 2 per cent. Assuming that these relative rates of increase are maintained after the war, it may be predicted that Germany's output of coal will overtake that of Great Britain about twenty years hence, when each country will be producing some 420,000,000 tons per annum. Although Germany's known reserves of coal are at present more than double ours, it may be doubted whether they will long outlast ours—assuming always that the present ratios between the annual percentage increases in the two outputs are maintained during the next fifty years (which is quite possible), but which will probably depend largely upon the magnitudes of the respective export trades of the two countries. In this respect, however, we have great advantages over Germany.

Coal Productions of the United States, Great Britain, and Germany—Quinquennial Averages 1900 *to* 1914—*Millions of Tons per Annum.*

	United States.	Great Britain.	Germany.
1900–04	288·2	226·8	112·5
1905–09	400·5	256·0	139·8
1910–14	519·2	269·9	168·7
Approximate percentage compound interest increase	6·0	2·0	4·0

The question of our coal export trade is one upon which much has been written from opposite standpoints. Some people view its rapid increase with feelings of concern, if not alarm, because they regard it as depleting, for the benefit of foreign countries, a national reserve of irreplaceable material, at the expense of future internal development; while others, who are perhaps more directly interested, regard it as a present source of wealth, the exploitation of which is indispensable to the maintenance of our position as the leading maritime and financial power. Without entering into any argument for or against either of the two opposite views, I may perhaps venture to put before you a few of the leading facts which must be taken into account in formulating any opinion or decision upon the question.

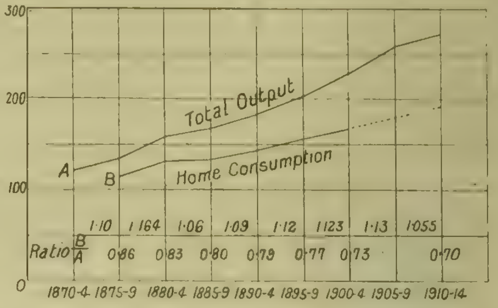
During the past sixty years our coal export trade has increased something like twenty-fold, both as regards the quantities and the values of coal exported. Moreover, its value relative to other values exported has, during the same period, increased four-fold, until to-day it constitutes about 10 per cent. of our total exported values. Thus in the year 1913, we exported 97·7 million tons, or 34 per cent. of our total output, valued at £53,000,000.

Another feature of our export trade is that whereas both the United States and Germany export considerable quantities of coal by land, their oversea exports are trifling compared with ours, and that in the year 1912 we actually transacted over 70 per cent. of the whole sea-borne coal trade of the world. Several factors have contributed to this astonishing result. One is the proximity of our finest steam coal seams to our ports, notably so the South Wales coalfield, which now exports more than 60 per cent. of its total output; another is the increased demands for coal from Europe and South America; while a third factor has been the phenomenal growth of our mercantile marine, which for successful competition with foreign tonnage depends upon good outward as well as inward cargoes. Inasmuch as the inward cargoes are chiefly foodstuffs and raw materials of considerable bulk in relation to their values, while our exports (except coal) are chiefly machinery and manufactured articles whose bulk is small in relation to their value, our shipowners are in a position to offer low freights for outward coal cargoes. Hence maritime supremacy and a large coal export trade are interdependent; and it is difficult to see how to restrict one without detriment to the other. Therefore, we must not expect any decline in our coal export trade, but rather the reverse, within the next half century.

Coal Production in Great Britain—Quinquennial Averages 1870 *to* 1914—*Millions of Tons per Annum.*

Period.	Average Output.	Calculated at 2 per Cent. Compound Interest.
1870–74	121·5	121·5
1875–79	134·0	131·1
1880–84	156·0	148·1
1885–89	165·0	163·5
1890–94	180·0	180·5
1895–99	202·0	199·3
1900–04	227·0	220·1
1905–09	256·0	243·0
1910–14	270·0	268·2

I will now ask you to consider a series of figures which I have prepared showing quinquennial averages, in millions of tons per annum, of the total coal raised in Great Britain between the years 1870 and 1914 inclusive, that is to say over a period of 45 years, which show how closely the continuous increase in production during that long period has followed a 2 per cent. compound interest law. These averages are shown as a curve in the next diagram, which also indicates the proportion of the whole production which has been retained for home consumption; while a third table shows that there has been a slight, but continuous, increase in the amount of coal consumed per head of the population during the past fifty years.



Great Britain, Coal Production. Quinquennial Averages. Millions of Tons per Annum.

Duration of British Coal Supplies.

Much has been written concerning the probable duration of British coal supplies; and I do not purpose to do more than touch upon the matter this afternoon. It has formed the subject of investigation by two Royal Commissions. The first one was appointed in consequence of the publication of the late Professor Jevons' great book on the Coal Question in 1865, and reported in 1871; and the second issued its report as recently as 1905. Since that date, however, Dr. Strahan, the Director of the Geological Survey, has published, in the report of the International Geological Congress in 1913, a revised estimate; and more recently still (1915), Professor H. Stanley Jevons, following up his father's work, has published another estimate in his remarkable book on the "British Coal Trade."

Estimates of Reserves of British Coal within 4000 *Feet of the Surface.*

	Million Tons.
First Royal Commission, 1871	146,480
Second Royal Commission, 1905	141,635
Dr. A. Strahan, 1912	178,727
Mr. H. S. Jevons, 1915	197,000

In making such an estimate, it is necessary to consider two overruling factors: (1) The maximum depth at which it is practicable to conduct mining operations; and (2) the minimum thickness of seams which can be profitably worked. The first of these factors is determined principally by the increase in temperature as we descend into the bowels of the earth. In this country the temperature at 50 feet below the surface is constant all the year round at 50° Fahr., and then it increases 1° Fahr. for every 60 feet lower in depth. Both Royal Commissions adopted 4000 feet as the maximum limit of practicable working, at which depth the temperature might be expected to be 116° Fahr. (the deepest mine in Great Britain equals 3500 feet, in Belgium 3773 feet), and 1 foot as the minimum workable thickness of seam. The 1905 Royal Commission reported that our reserves of coal within the said limits then amounted to 141,635,000,000 tons; but their estimate was certainly conservative, and did not, for example, include the Kent coalfield and other concealed measures. Dr. Strahan's more recent estimate for the same limits, which included the Kent coalfield and other items, was 178,727,000,000 tons; while Professor H. S. Jevons, who considers that Dr. Strahan erred if anything on the safe side, gives 197,000,000,000 tons as a maximum quantity within 4000 feet from the surface. Adopting this as an outside estimate, and deducting 15 per cent. on account of "pit wastage"—*i.e.*, coal which is left for one reason or another in the workings—we obtain a new figure for actually available coal at the surface of (say) 168,000,000,000 tons, or (say) 580 times our present annual output.

The serious aspect, however, of the local coal question for Great Britain is not how long can our reserves possibly last, having regard to the probable long continuation of the present upward tendency of our annual outputs—which is, after all, only an academic question—but how long we can continue to get the available coal at a cost which will not place us as a nation at a disadvantage relative to our nearest competitors.* From this point of view, the achievement of all possible economies, not only in the getting but also in the transporting and utilization of coal, is of the greatest possible importance, especially in view of the heavy burdens which war taxation must inevitably impose upon commerce and industry. I will therefore invite you to consider with me the immediately important question of how far we are now making the best use of the coal which we annually consume, and in what directions we may expect to realize much needed economies, either by the adoption of improved methods or by the better control or supervision of existing ones. For it cannot too often be insisted that the true line of economy lies not so much in the direction of imposing artificial restrictions upon either exports or domestic supplies, as in an insistance upon the coal raised being utilized to the best and fullest advantage by every class of consumer.

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* The average price of coal at the pit head increased during the period 1897-1910 by no less than 38 per cent.

Beilby's Analysis of Coal Consumption in the United Kingdom.

		Million Tons.		Per Cent.	
I.	Mines	18·0	..	10·8	42·5
	Factories	53·0	..	31·7	
II.	Iron and steel industries	28·0	..	17·4	
	Other metals	1·0			
III.	Brick-works, potteries, glass and chemical works, &c.	5·0	..	3·0	
IV.	Gas-works	15·0	..	9·0	
V.	Railways	13·0	..	7·8	9·0
	Coasting steamers	2·0	..	1·2	
VI.	Domestic purposes	32·0	..	19·1	
		167·0	..	100·0	

In connection with the work of the second Royal Commission on Coal Supplies, Mr. George Beilby prepared an estimate, from data got together by the Board of Trade, of the quantities of coal consumed in the United Kingdom for various purposes during the year 1903, when the total home consumption amounted to 167,000,000 tons. Of this total, factories and mines accounted for 71,000,000 tons (or, say, 43 per cent.); 28,000,000 tons (or, say, 17 per cent.) were consumed in iron and steel works; another 15,000,000 tons (or, say, 9 per cent.) were carbonized in gas-works for the manufacture of town gas; railways accounted for 13,000,000 tons (or, say, 8 per cent.); while 32,000,000 tons (or, say, 20 per cent.) were used for domestic purposes—leaving only 8,000,000 tons (or, say, 3 per cent.) for all other purposes, including glass and pottery works, chemical works, and the like.

Unfortunately, Mr. Beilby's estimate has not been kept up to date; and it is not possible to give any official figures relative to the 190,000,000 tons of coal consumed in the kingdom during the year 1913. From such unofficial estimates as are available, however, it would not appear that there has been any material alteration in the proportionate distribution of the total yield since Mr. Beilby's estimate was published. Assuming this to be so, it follows that if the coal used in mines, factories, iron and steel works, and for domestic purposes be lumped together, practically four-fifths of the total consumption will be accounted for. It is also in these directions that there are the greatest margins for economy.

Before, however, considering the probable magnitudes of these margins, I would venture, as a chemist, to suggest that what should be aimed at in all schemes of fuel economy is the abolition, wherever possible, of the present truly barbarous custom of burning raw coal, which not only entails the loss of valuable bye-products, but also involves the production of black smoke, with all its attendant evils. I am, of course, aware that in certain industrial operations—as, for instance, those in which reverberatory furnaces must be used—there may be at first some difficulty in finding a satisfactory alternative to the combustion of raw coal; but such difficulties can and must in course of time be overcome. In the vast majority of cases, however, no adequate excuse can be made for the continued use of raw coal.

CARBONIZATION OF BITUMINOUS COAL.

This brings me to the subject of the carbonization of bituminous coal, by which term is meant the destructive distillation of coal in closed retorts or chambers, out of contact with air, whereby the volatile matter—tar, benzol, gas, and ammonia—is expelled and a residue of coke or "semi-coke" is left behind. In this way it is possible, with a properly-arranged auxiliary plant, to recover all the valuable bye-products and to utilize the gas for power or heating purposes; while the residual coke or "semi-coke" is, for many important purposes, superior as a fuel to the original coal, both on account of its higher calorific intensity and the smokelessness of its combustion.

The hard coke obtained by the carbonization of coal in suitable chambers at high temperatures is the fuel employed for the smelting of iron in blast-furnaces, and for melting iron in foundry cupola furnaces; and there is no reason why the somewhat softer coke produced in gas-works, or, even more so, the "semi-coke" obtained by carbonizing coal in iron retorts or chambers at comparatively low temperatures, should not in the near future entirely displace raw coal as a domestic fuel, except, of course, in the many cases where gas-heated fires or ovens are preferably installed. The particular point I wish now to bring home to you is that the continued use of more than 30,000,000 tons of raw coal, instead of coke, semi-coke, or gas, as domestic fuel means that we are deliberately sacrificing, for the sake of a big blaze in the fire-place, the whole of the ammonia, tar, benzol, naphtha, and other bye-products, the value of which would in the aggregate amount to many millions of pounds per annum, and at the same time we are unnecessarily adding to the atmospheric pollution of our great towns and cities by the smoke which goes up our chimneys.

The nature and proportionate yields of the bye-products obtainable by the distillation of coal will obviously depend principally upon two factors—namely: (1) The character of the raw coal; and (2) the temperature at which it is carbonized.

At the high temperature prevailing in coke-ovens and gas-works retorts are obtained: (1) Coke, which is essentially carbon *plus* the ash of the coal; (2) benzenoid and phenolic tars, together with ammonia liquor; and (3) from 10,000 to 12,000 cubic feet of gas per ton of coal, the calorific value of which may be anything between (say) 500 and 550 B.Th.U. per cubic foot.

CARBONIZATION AT LOW TEMPERATURES.

Low-temperature carbonization, on the other hand, is still only in the early stages of its technical development. But, helped by the war demands for high yields of light oils, it is now being energetically pushed forward; and provided that it is honestly worked at on sound lines, as a technical proposition, and with scientific supervision, but with no attempt at financial "booming," its future is, in my opinion, assured as an adjunct of the older systems of high-temperature carbonization, especially in view of the growing demands for light oils as motor fuels. There certainly will be room on the market for the products of all carbonizing systems, which, from the standpoint of public interest, should be encouraged and developed to their utmost limits.

Low-temperature distillation (say, at 400° to 500° C.) has the effect of decomposing the smoke-producing "resinous" constituent of the coal referred to in my last lecture, leaving a porous semi-coke, which is easily burnt in an open fire-place, and is smokeless in its combustion. The suitability of such a fuel for domestic purposes is obvious, provided always that it can be produced in a form which will stand transport by rail, and at a price which is substantially less than that of raw coal; for this is the *crux* of all low-temperature carbonization schemes. The tars obtained at low temperatures are richer in light oils than ordinary gas-works tar. Moreover, they contain paraffins, naphthenes, as well as benzenes and phenols; and from the point of view of motor fuel they are very interesting. The gas obtained is naturally much smaller in volume, but richer in its content of methane and paraffins, than that obtained at high temperatures. The question of low-temperature carbonization is so important at this juncture that the Government would do well to have its prospects investigated and reported upon by a body of independent and disinterested experts, as a precaution against possible set-backs due to foolish or premature company promotion, which so often in this country ruins the commercial prospects of a good thing. What is needed is a great deal of the kind of wisdom "that maketh rich but addeth no sorrow."

In the year 1913, about 40,000,000 tons of coal (or approximately one-fifth of the entire output) were carbonized in the United Kingdom—namely, about 20,000,000 tons in gas-works, primarily for the mannfacture of town gas, and another 20,000,000 tons in coke-ovens, for the manufacture of hard metallurgical coke. Now in a modern gas-works the heating of the retorts is effected by the combustion, usually in two stages, and on regenerative principles, of a part of the coke produced; and the auxiliary plant is so designed that the whole of the valuable bye-products—including, if necessary, even the benzol and toluol—can be recovered, so that, under efficient management, the process becomes very economical so far as the utilization of all the products is concerned.

The gas industry is also to be credited with the achievement of two great improvements within recent years—namely: (1) The substitution of vertical for horizontal retorts, which, besides reducing labour charges, has resulted in appreciable economies in the coke consumption requisite to maintain a proper carbonizing heat; and (2) the introduction of the new nickel-catalytic process for the removal of carbon bisulphide from coal gas, which has now been brought to a successful issue by the combined skill and efforts of Mr. Charles Carpenter, D.Sc., Mr. Doig Gibb, and Mr. Evans, of the South Metropolitan Gas Company. They have shown that the sulphur (as CS_2) content of London gas can be reduced on a large scale, in regular day-to-day working, from nearly 40 grains to about 8 grains per 100 cubic feet, without in any way deteriorating the quality of the gas, at a cost (including interest and depreciation) of 0·299d. per 1000 cubic feet—thus providing a striking example of what may be achieved in industry by (to borrow Mr. Carpenter's own phrase) "the unrestricted and unreserved collaboration of the chemist and the engineer."

BYE-PRODUCTS RECOVERY.

Turning, now, to the manufacture of metallurgical coke, though the bye-product recovery system has made great strides in this country during the past few years—as is evident from the fact that the amount of ammonium sulphate produced in coke-works increased from 17,435 tons in 1903 to 133,816 tons in 1913—it is nevertheless a deplorable fact that out of the 20,000,000 tons of coal carbonized in coking plants in the year 1913, no less than 6·5 million tons were treated in the old wasteful beehive ovens. Inasmuch as each ton of dry coal carbonized in bye-product ovens yields from 20 lbs. to 35 lbs. of ammonium sulphate, from 56 lbs. to 112 lbs. of tar, and from 2 to 3½ gallons of crude benzol, &c., according to the locality, as well as about 5000 cubic feet of surplus gas (the fuel value of which for industrial purposes may be reckoned at about 2·5d. per 1000 cubic feet), it would appear that the dead-loss in values to the country on account of the 6·5 million tons of coal carbonized in beehive ovens during the year 1913 amounted to nearly £2,250,000 sterling. In the face of such a fact as this, what do you imagine our rulers are doing? They are closing the British Museum and the National Portrait Gallery! I venture to repeat a suggestion which I made in my British Association address—namely, that public interest would justify the

Government fixing by law a reasonable time-limit beyond which no beehive coke-oven installation would be allowed to remain in operation, except by express sanction of the State, and then only on special circumstances being proved.

The question of the universal adoption of bye-product coking ovens, with benzol recovery systems, in the manufacture of metallurgical coke in this country is of such pressing importance at this crisis that I may perhaps venture to give a brief description of one of the most up-to-date plants which has recently been put into operation in the North of England, and upon whose design and installation very great chemical and engineering experience has been expended. It embodies what is known as the Otto direct recovery system; and by the courtesy of the erectors I am able to exhibit a series of photographs of the plant specially taken for this lecture.

Otto Direct Recovery Coke-Oven System.

The coke-oven is a rectangular chamber about 30 ft. long by 7 ft. high by 20 in. wide, with refractory fire-brick walls, and is built in batteries of from 40 to 60 ovens, with vertical side-flues between each oven, in which gas is burnt on a regenerative principle in order to maintain the high temperature required for satisfactory coking. The coal, crushed to a suitably small size, is charged into the hot oven through openings in the crown, from small hoppers which carry the coal from the storage bunkers on rails running along the whole length of the top of the batteries. The charge is then levelled, and all openings closed and sealed, so as to exclude air during the subsequent carbonization. At the conclusion of carbonization the doors at each end of the oven are opened, and the coke discharged by an electrically driven ram on to a sloping bench, where it is rapidly quenched with water.

The hot crude gas leaves the oven by an iron "ascension" pipe, which conveys it through a dip-pipe under a tar-seal into the hydraulic main—a long iron trough running the whole length of the battery of ovens, and through which hot tar is circulated. In the hydraulic main the heavier pitchy tars are deposited. The gas then traverses in succession a long horizontal pipe and an atmospheric cooler, of such length and capacity that the hot gas is cooled to its dew-point, which temperature naturally varies in accordance with the quantity of moisture the gas is carrying. The gas then passes on to the tar extracting apparatus, worked on the injector principle, where it is met by a large volume of hot tar and liquor, forced through the narrow neck of the injector (under high pressure) along with the crude hot gas. The hot tar and liquor are thus broken into a spray which dashes against the small tar particles in the crude gas, the effect of which is to collect and precipitate the whole of the tar in the gas. The gas thus extracted overflows into specially constructed tanks.

The tar-free gas, which still contains the ammonia, naphthalene, benzols, and all its moisture, passes next into a large enclosed vessel, called the "saturator," containing hot dilute sulphuric acid. In this vessel the gas is divided into a large number of small streams, which are drawn through the weak acid liquor by the suction of an exhauster. All the ammonia in the gas combines with the acid, forming ammonium sulphate, which is precipitated on the coned bottom of the saturator, where it is continuously ejected by means of compressed air into a receiver, where it is separated from any liquor (which is returned to the saturator), and thence is passed to a centrifugal dryer.

The gas from the saturator, still containing the benzols, naphthalene, and moisture, passes through a lead-lined catch-pot, which is so placed that it prevents any acid spray being carried over from the saturator, and then on to the bottom of the naphthalene extractor and spray cooling tower. This tower is quite devoid of any packing, but at the top of it there are several jets through which cold water is sprayed at high pressure. The action of this mass of finely-divided cold water beating suddenly down on to the hot gas produces a sudden chill, which, together with the concussion brought about by the water, precipitates and washes out nearly all the naphthalene, which then flows away along with the water into a catch-tank beneath the apparatus.

The gas, still containing the benzols, passes next through an exhauster, then through a second water-cooler, where the last traces of naphthalene are deposited and the gas itself is cooled down to practically atmospheric temperature. It passes thence to the benzol tower scrubbers, where it is washed with an oil which removes the benzol from the gas by a process of simple solution. These scrubbers, which vary in number according to the size of the plant, are from 50 to 70 feet high. The lower portion of each scrubber contains a reservoir for the circulating oil, while the upper portion is filled with a series of wooden grids. The oil is continuously circulated through these grids, and the gas, having to pass through innumerable thin layers of oil thus exposed to it, gives up the greater part of its benzol to the oil, and is practically debenzolized. On leaving the scrubbers, about one-half the debenzolized gas is returned to the ovens, where it is burnt to provide the coking heat; while the other half is a surplus, which may be used either for firing boilers, or for raising power in gas-engines, or as a public supply of town gas, to which it closely approximates in quality.

The crude benzol removed from the gas is subsequently rectified by special treatment in another portion of the plant, and finally leaves the system as benzol, toluol, xylol and solvent naphtha.

The Domestic Consumer.

If, in conclusion, I return to the domestic consumer, it is merely because he is not only the chiefest of sinners, but he is also the hardest to bring to the penitent form, and to establish in a state of grace. Even at the risk of being accused of labouring the point, I want to impress upon you the importance of looking to some form of carbonized coal, or the gas obtained in its manufacture, as the proper solution of the domestic problem.

The use of gas-fires is deservedly extending, because they are now very efficient, both in regard to their radiant power and from a hygienic point of view. The latest types have a radiant efficiency of 45 per cent. on the net calorific power of the gas consumed. They also burn silently, and ventilate a living-room nearly as well as a coal-fire; so that no one need now have any hesitation in installing a gas-fire from the point of view either of health or of its radiant power. A gas-fire is absolutely clean, requires no stoking, and can be lit up or turned off at a moment's notice, all of which advantages are absent in any form of fire burning solid fuel. On the other hand, with a good house coal, at as many shillings per ton as town gas is pence per 1000 cubic feet, it is possible to obtain for a given outlay almost five times as many heat units in the form of coal as in the form of gas—a fact which all advocates of gas-fires must reckon with. What we want in all great centres of population is cheaper gas, if we can get it; and yet there are many municipalities owning gas-works who artificially keep up the price of gas by the fatuous policy of taxing the gas consumer for the relief of rates.

Under present conditions, therefore, the use of gas-fires will in the main be limited either to flats or to rooms which are either only occasionally used, or are merely occupied for short periods during the day or evening—as for instance a dining room, or a professor's library. But where a room is in use every hour of the day, and every day during the week, I think we shall have to employ some form of smokeless solid fuel. If my friends in the gas industry are inclined to disagree with this conclusion, I would remind them that they are large manufacturers of coke as well as of gas; and so what they cannot have as meal they may appropriate as malt.

Professor Bone proceeded to describe the fire-place designed by Mr. Vernon Harcourt, and used by him for many years, which is specially adapted for the burning of coke. An illustration of the fire-place was given in the "Journal" for May 11 last (p. 332), in the course of the report of a lecture delivered by Mr. Vernon Harcourt before the Society of Arts.

COKE-OVEN MANAGERS' ASSOCIATION.

Proceedings at Saturday's Meeting.

A Meeting of the Coke-Oven Managers' Association was held last Saturday, at the Department of Applied Science of Sheffield University—the President (Mr. George Chrisp) occupying the chair.

Election of Members.

It was reported that the following gentlemen had been elected by the Council to membership of the Association: Mr. A. T. Thomson (Manvers Main Colliery) honorary member, Mr. E. A. F. Knott (Blaydon-on-Tyne), Mr. G. A. Todd (Pease and Partners), and Mr. W. C. Phillips (Manvers Main).

Amendment of Rules.

Notice of motion had been given by Mr. B. Wilson Haigh (Hon. Treasurer) of an amendment of the rules of the Association providing for a widening of the membership conditions in a manner which would render the honorary membership closely exclusive and reserved, and provide a place in the Association, as associates, for gentlemen connected with the industry but not qualified as coke-oven managers for ordinary membership. Mr. Haigh explained that he would be inclined to apologize for moving a change of rules so early in the history of the Association; but he had proposed a motion to the same effect at the meeting at which the rules had been constituted. It had not been found possible, however, owing to the circumstances of the moment, to give it due consideration; and events, it appeared to him, since the Association had got on its feet, had proved the need of some such provision. Mr. Haigh proceeded to illustrate in detail the classes of gentlemen who, by the proposed change, might be brought into the Association, greatly to its benefit.

Mr. Fred Hadfield seconded the proposition, on the ground that the strict reservation of the honorary membership list would greatly add to the status of the Association.

Mr. E. M. Myers, while heartily congratulating Mr. Haigh upon the care with which he had prepared and worked out his scheme, moved its rejection, on the ground that, above all else, the Association was primarily a Coke-Oven Managers' Association. They had already six honorary members, whose place in the Association would be rather uncertain if the new rule were adopted. There were other considerable objections to the scheme, in the possibility of a hesitancy of free discussion among younger members of the Association if some superior in the same concern or a coke-oven inspector happened to be in the room.

The Honorary Secretary (Mr. J. T. Price) seconded the amendment.

After a considerable discussion, in which several members joined, the proposition was defeated on a vote.

The Chairman then announced that the Staffordshire members had a proposition which they desired to bring forward. The proposition of the Staffordshire district managers was at present taking up a good deal of the time and attention of the Council. It was that the Association, practically at once, take steps to form branches in different areas of the country, and that a representative of each area should be co-opted on to the Council. The Staffordshire managers felt that they were rather out in the cold. Personally, he thought it was a matter with which the Council were in tolerable agreement, and believed that it was in the best interests of the Association and of the craft that such branches should be established. Mr. Myers was there that evening to speak on behalf of the Staffordshire members; and he believed he was instructed to press the point that it was a matter of some urgency which should, if at all possible, be definitely dealt with that evening.

Mr. E. M. Myers said the coke-oven managers of Staffordshire, with the exception only of two, lived and worked in an area within four square miles; so that some time ago—before the Association was formed—they used to meet regularly at each other's houses or in a local hotel to talk over various matters relating to the technical working of their plants. They were very keen now that this should have recognition from the Association, and that they should have direct representation on the Council. He had acted as a kind of Secretary to the little group; and on behalf of his colleagues he moved the formation of sections or branches up and down the country, each to have one or more—he suggested no hard-and-fast line—representatives on the Council of the Association. Rule 25, of course, would have to be rescinded in order to make this possible—the rule being that the Council shall consist of the officers and five members of the Association, together with *ex-officio* members. He would very much like, on account of the fact that the Staffordshire members were such a long way from Sheffield, that this matter could be discussed and sanctioned or rejected that evening.

The President said it was against all rules of debate that this matter should be considered that night—no notice of motion having been given. The only way they could deal with it, if they wished to do so, was by the suspension of Standing Orders.

Mr. Myers said in that case he moved the suspension of the Standing Orders.

Mr. P. B. Nicholson seconded the motion.

Mr. Haigh moved a direct negative, on the grounds that, in view of the discussion they had already had that evening, they should be very careful as to altering rules, particularly in regard to rushing a matter through, as seemed to be desired in the present instance. He was fully in sympathy with the idea of the Staffordshire members; but he thought it should not be rushed. The Association should have presented to it some details of the proposed constitution of the branches, and suggestions as to the financial cost and responsibility. They should be given more time and more constructive details to think over.

Mr. J. A. Lee quite agreed with the point of view of Mr. Haigh that it would be much better to deal with this matter in the ordinary manner. There was, he suggested, nothing to prevent the members in different districts meeting together in an informal way and discussing matters and bringing their results to the Association; but he could see no special reason why they should rush the present proposal through. For this reason he seconded the amendment.

Mr. Myers, replying, said the coke-ovens of this country were not all in the Sheffield district. He would like to know how many members from over twenty or thirty miles from Sheffield were regular attendants at the meetings in Sheffield. He was convinced that by the formation of branches the Association would develop more rapidly.

Mr. Haigh said they were all agreed on that; it was only a question of whether they should vote that night.

Mr. James Marshall said he could not see the occasion for the hurry. He thought they should have time to consider the proposition, and vote at the next meeting.

Mr. Myers said the distance from Staffordshire was very great, and the journey meant a strain on the time and pockets of those members if they wished to travel to Sheffield even once a month. He could not think it was likely that the members of the Association would change their minds on the need of the branches between that evening and the next meeting.

Mr. Marshall said the idea of the Staffordshire men having a representative on the Council had the full approval of the Council; but they did not wish the thing to be rushed.

Mr. Myers remarked that there were other areas besides Staffordshire which could be very advantageously formed into district branches.

The motion for the suspension of Standing Orders was defeated. Mr. Myers then gave notice of motion of his proposition.

The President said he would suggest that Mr. Myers or one of his colleagues should be present at the next meeting and bring up a scheme of working.

Three Methods of Sulphate of Ammonia Manufacture.

Mr. T. H. Riley, a member of the Council, then read a paper on "The Advantages and Disadvantages of the Three Methods of Sulphate of Ammonia Manufacture at Bye-Product Coke-Ovens." This, together with notes on the discussion to which it gave rise, follows the above report.

METHODS OF SULPHATE OF AMMONIA MANUFACTURE AT BYE-PRODUCT COKE-OVENS.

THEIR ADVANTAGES AND DISADVANTAGES.

By T. H. Riley, of Tinsley Park, Sheffield.

[A Paper read before the Coke-Oven Managers' Association, on Saturday, Jan. 29.]

The crude gases evolved during the carbonization of coal in retort-ovens contain ammonia and various other bye-products. The system in general use for the recovery of ammonia at coke-works until the year 1907 was the indirect process—*i.e.*, a series of tower scrubbers were used for stripping the gases of ammonia, using water as the absorbing agent. About this time the Koppers' semi-direct process was introduced into this country, and was first put into operation at the coke-plant belonging to the Flimby and Broughton Moor Coal and Fire-Brick Company, Limited, at Maryport. Patents, however, were taken out by Koppers in 1904 for both the semi-direct and the direct processes.

The three systems under consideration are:

Indirect Process.—The ammonia is recovered in the form of ammoniacal liquor, which is treated in a still.

Semi-Direct Process.—In this case the gases are cooled, and the resulting liquor, which contains the "fixed" ammonia, is treated in a still. The vapours mix with the preheated gases containing the greater part of the "free" ammonia before entering the saturator.

Direct Process.—There are no water condensers in this system for cooling the hot gases before the saturator.

The Indirect Process.

The water vapours (which contain about half the ammonia) are removed, along with the heavy tar, by condensation of the hot gases drawn from the hydraulic main, the condensates being collected in a tank (or tanks) and separated. The cool gases, at a temperature of about 25° C., are then forced through a tar extractor to remove the tar, preparatory to their entering the ammonia scrubbers or washers. The weak liquor and added water used for absorbing the ammonia in the gases are circulated through the scrubbers, after which the liquor, which contains about 1·20 per cent. of ammonia, according to the arrangement of the plant, is sent forward to the ammonia still, to be treated for sulphate of ammonia in the usual way.

The amount of liquor made at a forty-oven plant, carbonizing 270 tons of coal per day, containing 10 per cent. of added water, has been found to be 40·5 tons. This liquor is condensed between the ovens, the primary coolers, and the tar extractors. The additional fresh water required in the scrubbing plant is 50 tons, which means that a total of 90 tons of liquor has to be dealt with in twenty-four hours. The strength of the liquor is 1 per cent. of ammonia.

In many plants of this description an acid bubbler has also been used for taking out the final traces of ammonia by means of 60° Twaddel sulphuric acid—the resulting mother liquor being sent to the sulphate plant. Owing to the trouble which arose through dirty salt blocking up the dip-pipes of the bubbler (no doubt the semi-direct method originated this), bubblers were discarded, and a so-called improvement—an earthenware washer consisting of a series of trays—was tried; fresh water being admitted into the top tray and sulphuric acid in the tray immediately below. The washing was quite effective; but another trouble arose. It was found that the earthenware could not withstand the vibrations caused by the exhauster forcing the gases through the seals. The trays consequently were continually breaking; and this particular type of washer had a very short life.

With regard to the indirect method generally, the advantages are none, while the disadvantages are many:

1. A large number of pumps, storage tanks, &c., are required.
2. The plant occupies a large area, and demands a great deal of supervision.
3. The whole of the ammonia has to be recovered by distilling the ammoniacal liquor; and, consequently, a large quantity of effluent has necessarily to be dealt with, and a great amount of steam is required.
4. Inefficient scrubbing and loss of "free" ammonia, through the scrubber grids becoming blocked with naphthalene and sediment from the water used for washing the gas (if hard water is used), and, at times, should the sprinklers become blocked, from the unequal distribution of the water.

Koppers' Semi-Direct Process.

In this process the gases on leaving the ovens are cooled down to about 25° C.; the condensate being heavy tar containing the naphthalene and ammoniacal liquor. The exhauster then forces the gases through a tar-extractor, after which they are reheated with exhaust steam to a temperature of 60° C. At this point the vapours from the ammonia-still (the liquor condensed in this system is treated for its ammonia), having a temperature of 95° C., are mixed with the reheated gases, entering the saturator at 65° to 68° C., and combining with sulphuric acid to form sulphate of ammonia. After the gases leave the saturator, at a temperature of 60° C., they are again cooled to about 25° C. before entering the benzol scrubbers.

From actual observation the amount of liquor made at a forty-oven plant, carbonizing 270 tons of slack per day, containing 10 per cent. of added water, was 35 to 40 tons, of a strength of 1·1 per cent. ammonia. This was the quantity which required to be treated in the ammonia-still, during twenty-four hours.

The advantages of this process are many:

1. No naphthalene troubles.
2. Less risk of loss of ammonia.
3. Effluent considerably reduced.
4. Sulphate of better and purer quality.
5. Less steam required, as there is less liquor to be treated, and exhaust steam is used.
6. The plant is much simpler to work and is more efficient.

THE DIRECT PROCESS.

In this method the gases on leaving the ovens pass through air-coolers, being cooled from 150° to 85° C. The condensate consists chiefly of tar and ammoniacal liquor; the ammonia being in a "fixed" state. When the gases have left the coolers, they are drawn through special apparatus, coming in contact with hot tar-sprays under a high pressure, or centrifugal machines, to remove the final traces of tar and condensed vapours, and then through turbo-exhausters. [These have been found to be most suitable for dealing with hot gases.] After this, the gases enter the saturator at 70° to 75° C. under a pressure of about 12 inches water-gauge, and are deprived of their ammonia by means of sulphuric acid—leaving the saturator at 65° to 70° C. In the saturator well a dry steam-coil is used to prevent the formation of mother liquor from the moisture carried over with the gases.

After the gases have been stripped of their ammonia, they are condensed to remove the water vapours in suspension, and the naphthalene, before entering the benzol scrubbers. If the coolers are not of ample size, the water vapours will be carried along with the gases into the first benzol scrubber, thereby reducing the efficiency of the scrubbing oil.

With regard to the quantity of liquor containing "fixed" ammonia from the condensation of the gases between the ovens and the tar sprays or centrifugal machines, this, of course, is a variable quantity, according to the quality of the slack used. It is usually circulated round the plant, and when sufficiently concentrated it is either sold or treated separately, as blockages would otherwise occur in the gas-mains and other parts of the plant. This liquor is also a nuisance, due to some of the ammonium chloride separating out and attacking the wrought-iron mains and machinery. There is also another condensate peculiar to this system—viz., a mixture of water and naphthalene—which is condensed from the gases after the saturator. The naphthalene on cooling is made into a marketable product. The water, however, gives rise to similar trouble to that experienced in dealing with the effluent from an ammonia still.

The chief feature of this process is that probably more "free" ammonia passes direct with the gas to the saturator. The disadvantages of the system are:

1. More power is required than in the semi-direct process, owing to the high speeds of the centrifugal machines and turbo-exhausters. [If the liquor made were treated in a still, then even more steam would be required.]
2. Indirect loss of the "fixed" ammonia, owing to the salts crystallizing out in the gas-mains, and passing away with the tar.
3. Effluent from the final coolers.
4. Tar much thicker than in the other two processes.
5. Trouble is effectually removing the tar, owing to the gases being much hotter.
6. More wear and tear on a portion of the plant, due to the presence of ammonium chloride.

DISCUSSION.

The PRESIDENT said Mr. Riley's subject was one which lent itself to considerable discussion. The author, he knew, would welcome it. His criticism of the indirect process came rather as a surprise to him (the President). He himself had had no experience in the direct method, and he would be very glad to hear views on the subject. In the meantime, he had received by letter a few comments from Mr. G. Stanley Cooper, who was unfortunately unable to be present.

Mr. COOPER in his letter said Mr. Riley did not favour them with his views as to which of the three systems he really preferred, though it was fairly apparent from the advantages which he had given for the semi-direct process that his working experience of this was exceedingly favourable. He (Mr. Cooper) had a fair experience of direct and semi-direct recovery; and he gave his opinion unhesitatingly in favour of the semi-direct process as worked out by Koppers. To his mind it embodied all the other systems combined. Perhaps the only important point that it was at a disadvantage was the fact that some effluent liquor was produced. The principal claim which was made on behalf of the hot direct-recovery process was that there was no production of ammoniacal liquor, and hence no distillation was required. He had visited a number of plants, both here and in Germany, and he had never yet found that this claim could be substantiated. It was rather interesting to follow it out to its logical conclusion. In the first instance, particularly when compressed coal was used—which meant that the total production of ammoniacal liquor was not less than 12 per cent. of the weight of coal—it was very difficult to maintain such a temperature round the plant that the whole of this liquor was kept in a state of vapour. The difficulties involved in attaining this were so great that the users of the hot direct processes fell back on the device of allowing just a little condensation. Now they knew perfectly well that if they allowed any condensation whatever, the condensate would contain a proportion of both free and fixed ammonia. Without condensation the fixed ammonia passed forward with the gas into the saturator, where two reactions were possible. Either ammonium chloride—which was the principal constituent of the fixed ammonia—was decomposed with liberation or hydrochloric acid gas, or it remained as ammonium chloride in the sulphate; and the ammonia value being higher in chloride than in sulphate, equivalent value was not obtained. In the first instance, the presence of hydrochloric acid in the mains soon became evident by the amount of corrosion which went on, and the heavy wear and tear of the apparatus generally. If, then, proper recovery of the fixed ammonia was to be made, there must be condensation. At the plant with which he was associated, for instance, one-third of the ammonia yield was fixed ammonia, and he was sure could not have been efficiently dealt with under the hot direct-recovery process. They got then the fact that condensation was necessary to eliminate the fixed ammonia. Such condensation also necessarily involved a solution of a proportion of free ammonia in the liquor; and to recover this free ammonia distillation in some form or other was necessary—a process not allowed for in the hot direct system. Without condensation and cooling of the gases to a temperature of less than 40° C., a considerable quantity of water vapour remained in the gas, with the result that this was frequently deposited in the saturator, thereby diluting the liquor. They knew that the action between sulphuric acid and ammonia was exothermic, and it was able to supply to some little extent the heat required to evaporate the water which would otherwise be deposited in the saturator. It was, however, not sufficiently exothermic to maintain the strength of the bath with the hot direct-recovery system without either some condensation or external heating of the mother liquor. The latter was frequently resorted to; but it was attended with very grave difficulties. He questioned whether there was a plant in the country, working under the conditions which Mr. Riley worked under, which was getting the same sulphate yield as he was obtaining. By this, he meant sulphate yield actually, and not sulphate equivalent. He knew of plants where the hot recovery process gave good yields of ammonia; but, unfortunately, a proportion of it was in the form of that liquor which they were not supposed to make, and which was sold in bulk, because they had no facilities for recovering the ammonia it contained without resorting to the distillation which they as loudly disclaimed as being necessary. The author was right in pointing out that the effect on the tar was also very noticeable with the hot direct-recovery process; but it could hardly be called tar so much as pitch. With ordinary precautions pitch troubles were comparatively rare with the semi-direct process, as also were naphthalene troubles; but he was given to understand that they were exceedingly common with hot recovery. He would, however, like to congratulate Mr. Riley upon the excellent way in which he had put before the members the principal points for consideration in comparing the three systems of ammonia recovery. He agreed fully and entirely with the points he had put forward in respect of each, and would certainly advocate the semi-direct process of the Koppers type as being the simplest, and at the same time the most efficient, for ammonia recovery.

Mr. HAIGH said he could not claim for the semi-direct process that there was a 10 per cent. yield of ammonia, as there was in the indirect process. Perhaps Mr. Riley could tell them if there was any increased yield at all, and what was the difference between the two processes. He was rather sorry the paper was short of figures; but they knew that figures were difficult to obtain. He would have liked to hear something of comparative initial and working costs of the three systems. He believed the first cost of a semi-direct plant was higher than that of the indirect plant.

Mr. RILEY said, in regard to the yield of sulphate of ammonia in connection with an indirect plant, at the plant at which he had been engaged they had taken an average for the first twelve months of its working, and found that the lowest yield was 25 lbs. and the highest 27 lbs. Since starting the semi-direct plant the productions had considerably increased, though using a similar size of coal. They found their average was about 31 lbs., and their best figure had been 33 lbs. With regard to a point raised by Mr. Haigh as to steam, he really could not give any definite figures; but on their semi-direct process they had two Lancashire boilers, which it had been thought were hardly sufficient, and provision had been made for a third if necessary. They now found, however, that one boiler, heated by surplus gas, was quite sufficient. With regard to the cost, he was afraid if they went into this question they would sit there all night. If he had thought they desired information on cost, of course he would have endeavoured to provide some figures; but he did not know whether they would have agreed with them or not.

Mr. G. W. J. BRADLEY said Mr. Riley appeared to be very down on the indirect process. It seemed to be, first of all, from the quality of the salt. He (Mr. Bradley) thought that, if properly worked—as all coke-oven plants should be—the indirect plant would leave very little to be required in regard to the salt quality.

In connection with the semi-direct process, he knew very little. The author raised objection to the hot direct process on account of the effluent from the naphthalene cooler. The plant with which he was associated was using the naphthalene water for quenching the coke; so that it was all got rid of, and there was no objectionable effluent whatever. The sulphate of the direct process would not bear comparison with that of the other two methods. It contained the whole of the basis of the gas, and he believed it caused in some places considerable heating-up of the salt, due to oxidization. He would be interested to know how the consumption power bore comparison with the cost of reheating of the gas.

Mr. Riley said, in regard to the losses of ammonia and the shortage of acid in connection with the semi-direct process, of course, they had storage of ammonia. If their coolers were only powerful enough——

Mr. Bradley: But we are concerned with actualities.

Mr. Riley (continuing) replied that that depended largely on the plant. One trouble arose in one plant which they did not get in another. With regard to the direct process, if they were short of acid they lost fully 75 per cent. of their ammonia. As to the reheating of the gases, this was done by the exhaust steam, in his own case, from the exhaust boiler. With regard to the still for working the liquor, it was practically all exhaust steam there also. There was very little live steam.

Mr Myers said he had read a paper on the same subject some eighteen months ago. What he had found at that time, and asserted again now, was that the whole thing depended on what kind of coal was being distilled; and, therefore, on this question they must determine what kind of process they were going to put in. An important point which most people seemed to fight shy of was the fact that nearly the whole of the fixed ammonia was ammonium chloride. Was it not a retrograde step to separate this salt from ammonium sulphate? This was the very great disadvantage both of the semi-direct and the direct process. Mr. Riley was not quite correct, he thought, in saying that on the direct-recovery plants this ammonia was either distilled separately on the plant or else sold. If the liquor could be changed into marketable ammonia, then the process was not taking any retrograde step; and he was very sorry to say that, although direct-recovery plants had been working for about three years on a large scale in this country, very little had been done on this important subject. At his own place they were selling their ammonia as a marketable product for galvanizing. In any product which had to deal with coal that contained much ammonium chloride—15 to 20 lbs. per ton of coal—if these plants were going to separate up the salt they were not acting on true scientific principles. What was wanted now was a sound commercial process for making commercial and saleable ammonium chloride on a coke-oven plant.

Mr. Riley said, with regard to ammonium chloride, there was no doubt that in the semi-direct process they had to separate it up again. When the hot process was introduced into the country, however, it was said there was no condensation whatever; but then the trouble arose of the gas attacking the pipes. The pipes were afterwards lead-lined, but still there was trouble. It was then that the best thing to do was to cool the gases slightly, and so get rid of the trouble. There was no doubt that in many plants they had treated the ammonium chloride separately. On ammonia plants it was a nuisance to them, and they got rid of it in the tar or sold it to other people. They circulated round and round; and he knew of one case where it used to run away down the stream. It attacked the pumps, the wrought-iron mains and pipes, and was a nuisance. The sooner they could get rid of it or make it into a saleable substance the better.

Mr. Myers said he held no brief for builders of any process. But there was very little condensation on the direct-recovery plant. In his case, they got their liquor containing, at 15° C., about 15 per cent. of ammonia. The free ammonia in the liquor would be something like 0·02 per cent. They found that all free ammonia was useful, when the liquor was to be evaporated, to keep the liquor neutral and prevent any attack on the vessels in use.

Mr. Riley said at one plant working in the district for eighteen months past they made from their gases 20 lbs. of sulphate per ton of coal. The other 11 lbs. of the 31 lbs. total was the equivalent of sulphate of ammonia from the liquor sold.

Mr. Spencer asked why in the indirect process Mr. Riley only got 27 lbs. per ton, and in the semi-direct he got 30 lbs. per ton of the same coal.

Mr. Riley replied that there were many points in the indirect process which they had to watch as regarded wastage; whereas in the semi-direct there were very few. If their scrubbers were not large enough, the grids became blocked with naphthalene, or the sprinklers might not be distributing properly. In the semi-direct process there was direct control by the men and very easy supervision, and this was probably why there was this gain.

Mr. Spencer said they had something like 33 lbs. per ton of coal, and they lost about 0·5 per cent. per ton of coal, which Mr. Riley admitted was very good.

Mr. Myers said the only loss on his own concern's direct plant was due to the effluent liquor. He had examined several ammoniacal liquors, or, as it was called, obnoxious effluents. They kept it down to between 0·05 and 0·02 per cent.; and there were about 40 tons.

Mr. W. Green said he found in the direct plant that he had no difficulty in disposing of the effluent liquor from the coolers—that was, if the plant was worked properly. Also, in connection with naphthalene troubles, they had a system of removing the naphthalene from the gas as it went through the scrubbers, which worked quite satisfactorily. In regard to the effluent liquor, the ammonia contained in this liquor never reached 0·02 per cent., except in one or two special instances. It was generally between 0·01 and 0·015. He thought the plant was working very efficiently as regarded the ammonia loss, which was infinitesimal. In connection with the indirect process, Mr. Riley put the ammonia and the ammonia bye-liquor about one to one. He (Mr. Green) had heard this stated generally; but he had heard that it was not always true on the Koppers plant. He understood it said that the liquor was sometimes more than half. In connection with the indirect process, as regarded the blocking of the scrubbers, in his own case the gas was treated very well for the removal of the ammonia in an experience he had had with rotary scrubbers. The scrubbers never showed much trouble in this respect.

Mr. Myers asked if Mr. Riley would give them the approximate percentage of fixed ammonia.

Mr. Riley: I should think two-thirds fixed.

Mr. Green asked if it was fair to treat the systems for comparison on twenty-four hours' working. Would it not be better to take the average working for a week or a couple of weeks, as the coal varied considerably in quality? The quality of the coal on the two days selected for the comparisons of Mr. Riley might have been considerably varied.

Mr. Riley said, so far as he knew, there was practically no variation in the quality of the coal in use on the occasions of his comparisons.

Mr. Green said, in connection with the direct process, his concern had obtained 33 lbs. and 34 lbs. per ton; but this might be dependent on the quality of the coal treated. There was no doubt, however, that they had obtained a very satisfactory yield and a minimum loss in the process.

Mr. Lee said it was natural that those who had had particular experience of one system should think their system was the best. He, personally, had had much experience of the indirect process and little with the others. It seemed to him each of the three processes had its own distinct advantages for its own especial plants. Mr. Riley was hardly justified in saying there were no advantages for the indirect process. It was much more elastic than the other two systems. Those of them who were now having difficulty in producing their supplies of sulphuric acid, might be interested to know that in this respect the indirect process was proving the most elastic of the three methods. Every plant had a limit to its storage capacity; but they could get on with the concentration of their liquor in the indirect process in a manner which they could not possibly do in the other two processes. He thought the point raised by Mr. Myers was very important. It was wrong in practice that they should have some material which was already prepared for them to put on the market, and lay themselves out to decompose this material. It should be their business to go along on the lines at which they were aiming, with the minimum amount of expense in other material, to put on the market those things which were produced for them in their processes. In the long run that process would succeed which would produce the marketable sulphate of ammonia. He thought the semi-direct process would ultimately be that which would lend itself to being the best system to put in. It was certainly incorrect, therefore, to say there were no advantages in the indirect process. The fact was they all required very careful watching and management. He quite appreciated Mr. Riley's point that one could have more hours away from the plant which he chiefly recommended; but he had never known a manager to be called out to deal with difficulties of the indirect process, either in gas-works or in coke-oven plants. In every one of the processes the same call was made for efficient management and supervision, both in the managing and the chemical department. When these were done, every one of them would yield exactly the same ammonia from the same plant if conditions generally were equal. He was sorry Mr. Riley had not given capital and working costs of the three processes; for it was capital cost which would have to be considered when suggesting improvements or new plants. If he could have given to the paper the figures, it would have added materially to its value.

Mr. Riley said there was no doubt that if each of the systems was constructed in a right manner, and was conducted properly, and general conditions were equal, they could recover the same amount of sulphate from one as from another. With regard to the capital costs, if he had gone into these details it would have taken hours and days and weeks. As to working costs, between the semi-direct and the indirect there was very little, if any, difference. In the semi-direct they had had their troubles on their own plant. One wanted to work it one way and one another way; and even the men wanted to have their own way in the matter. At times, instead of making sulphate of ammonia, they were making rock salt. Since those times, however, they had overcome these troubles. There was another question. With the semi-direct process, owing to the fact that they cooled the gases to a normal temperature, the gases were practically free from moisture. On top of the ammonia still at his plant they had a condenser to further reduce any possible vapour; and the result was they had very little condensation, whereas Mr. Myers mentioned that his concern had had about 30 to 40 tons per day.

Mr. Myers said this figure was effected in their own case very largely by the amount of moisture in the coal.

Mr. Haigh said that Mr. Riley had somewhat modified his original statement, and said that they could get the same ammonia from the indirect as from direct methods, providing all things were equal.

Mr. Riley said that was so, if all things were equal. There was no doubt there was a loss of free ammonia in the indirect process. Probably most of it took place in the deposit tank, and also where they had open hydraulic mains.

Mr. Lee remarked that there could, of course, be very great loss through evaporation; but he took it they should all understand that it was their business to keep the tank covered, and that all their fittings should be covered. If not, they had better understand this at once. If they kept all their points covered there was very little loss of ammonia. The output at his place had been as high as 1·7 per cent., and their average was 1·65 per cent., though he admitted they had a good quality of coal.

Mr. Bradley said, in connection with the thickening of the tar, he had seen some of the thickest produced in the indirect process and some of the thinnest in the direct process. Surely it was a question of conditions, as suggested in regard to fixed ammonia, and there was nothing in it to condemn a system on.

Mr. Green said if they had the actual loss in each case they would get to the rock-bottom of each process, and would know which was the most satisfactory.

Mr. Marshall asked Mr. Riley if he could give some figures of comparative losses in the three systems. He presumed Mr. Riley would take his gas make both on the old process he had used and on the one he was now using. In the indirect processes he got, according to the paper, 25 to 27 lbs. per ton, and he (Mr. Marshall) took it that in getting the 31 and 33 lbs. in the semi-direct process, he was calculating on the same coal. What was the increase due to? Had he lost a lot of ammonia and sent it back and decomposed it?

Mr. Riley replied that in the indirect processes the loss in the return gas, worked out in pounds per ton of coal, was 0·02 lb., and the loss in connection with the semi-direct method was 0·003 lb. This was the best result they had had, but they had had very much worse. He might say that the losses in the semi direct process, if they watched the saturator bath, were very little indeed; but if the cracker-pipe became partially blocked up, there was unequal distribution of gases and consequent loss.

Mr. G. Taylor remarked that he thought the amount of sulphate should be expressed in terms of the amount of nitrogen in the coal, and he considered that if stated in such terms the amount of sulphate in all three processes would be quite clear.

A Member asked as to the effect of using these processes on the yield of benzol. If they took the semi-direct process, it was cooled down, heated up again, and had to be cooled down again, and he would like to know if it took much cooling to get it down to 15° once more. There was the question of the direct process. If they had to use a lot of water by external cooling, it might perhaps be better to cool by interior cooling by running the water down through the gas, as was done in the indirect process. He would like to know if Mr. Riley could give any information on this question, and as to whether he thought it was easily possible to get the gas down cool enough without extra cooling when using the semi-direct and the direct processes.

Mr. Riley said with regard to the semi-direct, at his place they had one cooler. The water came in direct contact with the gases; and they got the temperature down to about 22° C. It was very seldom—with the exception of occasionally very hot summer weather—that it got above 25°, and this could be avoided by running-off the water and getting a fresh supply. As to the hot process, of course, they had very much more water vapour to cool down; and it was due to insufficient cooling area that trouble arose in this respect in ammonia plants.

The Chairman, bringing the discussion to an end, said information in regard to the effect on benzol had been hitherto somewhat lacking. He was an indirect man himself; and his experience of the other two methods made him believe that, under proper conditions, the indirect could be made to produce as much sulphate as the others. It was certainly a very elastic system, and the amount of storage they could have was double or treble that of the other systems.

On the motion of Mr. T. Foster, seconded by Mr. J. Sylvester, a hearty vote of thanks was accorded Mr. Riley for his paper.

MODERN ILLUMINATION.

By E. Stroud.

[A Paper read before the London and Southern District Junior Gas Association, Jan. 28.]

This paper is the last of a series which the author has given this season before the different Junior Gas Associations. It was early found to be impossible to deal comprehensively with the whole matter set out in the synopsis. Therefore it was thought advisable to deal with the subject more or less in sections. The last paper, given before the Scottish Junior Gas Association on Dec. 11, dealt primarily with photometric or distribution curves of various sources. This present one will be principally on illumination calculations, and the method of deriving them from the photometric curve.

The distribution or photometric curve is the graphic representation of the light distribution. The intensity of light is taken for various angles in a vertical plane to the lamp axis, and plotted in terms of candle power, conveying a clear idea of the manner in which the light is emitted. In view of the differences of distribution it is possible to obtain with bare sources and with various reflectors, it is of paramount importance for the lighting engineer to know exactly what distribution he will obtain from any particular unit. To this end, with all commercial lighting units there should be published their corresponding distribution curves.

The Illumination Curve.

Having available the distribution curve of a light unit, an illumination curve can be derived, giving for any definite mounting height the foot-candle intensities of illumination at various distances out from a point directly under the light unit. This curve is derived by means of formulæ based on what are known as the inverse square law and the cosine law.

Inverse Square Law.

The illumination intensity on any surface varies inversely as the square of the distance between the surface and light source; and the fundamental law of illumination mathematically expressed is:

$$I = \frac{C.P.}{D^2}$$

in which I equals the intensity of illumination in foot candles, C.P. equals the candle power in a given direction, and D equals the distance in feet from the source to the surface. This holds true, however, only for surfaces at right angles to the ray of light, and does not apply where the light falls obliquely on the surface under consideration.

In practical illumination, most of the rays do not meet the surface normally. When this is so, the horizontal illumination may be obtained by calculating the normal as above; and these results multiplied by the cosine of the angle between the ray of light and a perpendicular line drawn from the light unit to the illuminated surface.

$$I_h = \frac{C.P.}{D^2} \text{ Cos A}$$

In this formula, however, both D and A are variable for points at different distances out from the point directly under the light unit.

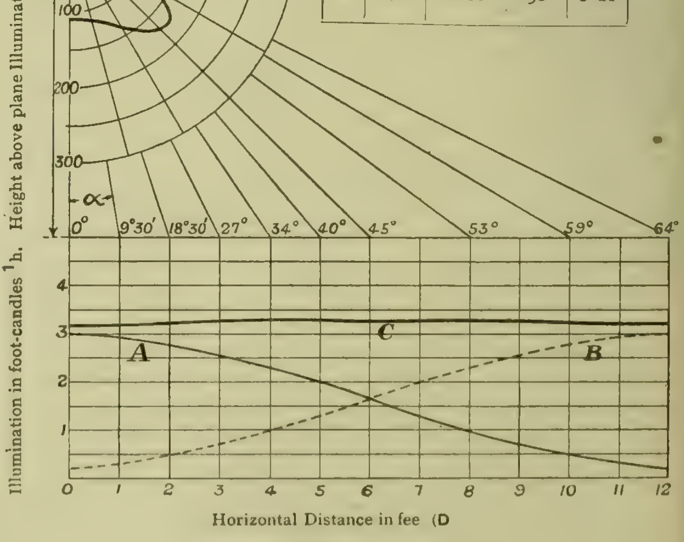
By the simple trigonometrical method known as Lambert's Law, this formula can be converted into one involving instead of D the perpendicular height H of the light unit above the plane. The formula then becomes:

$$I_h = \frac{C.P.}{H^2} \text{ Cos}^3 \text{ A}$$

Having at hand a table of cubed cosines for the different angles, and since in any given problem H^2 is constant, we have to determine only the candle power at the various angles in order to solve the illumination at any point.

Fig. 1 shows an example of the actual derivation of an illumination curve from a photometric curve. The photometric curve is first plotted in the upper left-hand corner of the figure.

Horizontal Illumination $I_h = \frac{C.P.}{H^2} \cos^3 a$



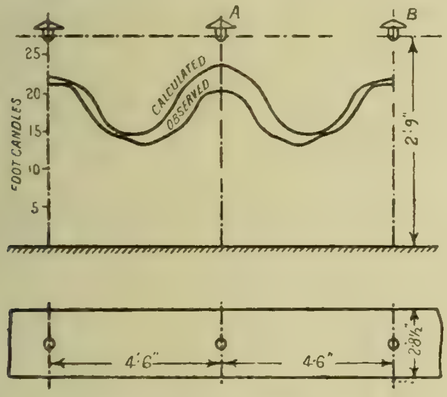
D	a	$\text{Cos}^3 a$	C.P.	I_h
0	0	1 00	108	3·00
1	9·5	0·96	109	2·90
2	18·5	0·85	117	2·77
3	27·0	0·71	128	2·51
4	34·0	0·57	145	2·30
5	40·0	0·45	160	2·00
6	45·0	0·35	169	1·66
7	50·0	0·27	174	1·28
8	53·5	0·21	168	0·98
9	56·0	0·17	155	0·72
10	60·0	0·13	135	0·49
12	64·0	0·08	90	0·21

Fig. 1.

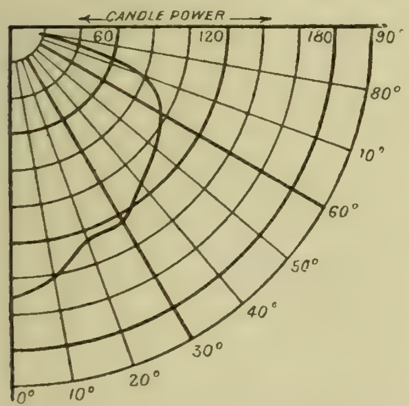
The height above the plane of illumination is assumed to be 6 feet in this case. Then the ray of light at 45° out from the downward direction will strike the plane of illumination 6 feet out from the point directly under the unit. This gives the basis of the horizontal distance scale for the illumination curve; and the distance scale may be laid off, using distances apart of 1 foot for the small angles, and distances of 2 feet for the higher angles. It is only necessary then to carry back the radial lines for the 1 foot and 2 feet intervals until they intercept the photometric curve, and read the candle power at the points of interception.

These are entered in the table in the upper right-hand corner of the figure, as shown, multiplied by the proper value of the cosine cubed, and the product divided by the square of the height—in this case 36. The result is the horizontal illumination for the given point. This process is repeated for the other points. Then a scale of foot candle intensities is assumed for the diagram and the derived values of I_h are plotted as vertical distances, giving us the resulting illumination curve for the unit in question at the given height of 6 feet above the plane to be illuminated.

With the illumination diagram at hand, it is possible to find the illumination at various points in any space under consideration with a given position of the light units; the illumination at each point being the sum of the illumination at that point from each separate unit. All of these latter are determined, of course, by the distance of the point from each light-source. By the "point-by-point" method, as it is called, the illumination, neglecting reflection from the surroundings, can be determined with considerable accuracy. This accuracy has been proved many times by the author, and was also shown conclusively in a paper given by Professor Clinton before the Illuminating Engineering Society in March, 1914. One particular installation proved by Professor Clinton is shown. This was the local lighting of a work bench by incandescent gas-burners. Fig. 2 shows the spacing and plan of bench, together with calculated and observed curves of illumination, and also the polar curve of the unit. The difference between the mean of the calculated and observed values is less than 5 per cent. Reflection from surroundings would have very little effect in this or any case of local lighting.



Ilumination of Workshop Bench.



Polar Curve of Lamp and Fitting used in Lighting Bench.

Fig. 2.

These illumination curves are often very necessary and useful. But in practice shorter methods are employed. Tables are available giving for various heights and distances out the angle of the light ray and the foot-candle intensity of illumination produced by 1-candle power. To apply this to any photometric curve, it is simply necessary to read the candle power from the curve at the angle given, for the height and distance out selected, and multiply this candle power by the illumination which 1-candle power produces at this point. With these tables, it is possible to obtain quickly the horizontal illumination which any light-source of known distribution gives at any point.

Spacing of Units.

The spacing of units is sometimes fixed by architectural considerations; but as far as possible it is advisable to arrange the lighting units in the form of squares or rectangles, placing a unit in the centre of each. It is assumed that it is required to obtain even illumination over the working area. Therefore upon the distance between the units and the height at which the units can be placed will depend what form of distribution curve one will require. The use of the illumination graph for this purpose is most clear.

The more focussing the reflectors are, the closer together they must be, relative to the height, to get even illumination. Though, of course, the closer the units the higher degree of illumination one would get. Illumination problems generally call for one of three types of distribution—known as "extensive," "intensive," or "focussing"—and reflectors are designed to this end.

With the units placed at the same height, the illumination is increased from the extensive to focussing, though the area covered is decreased. Conversely, one could place the focussing reflector much higher, and obtain the same illumination over the larger area. Therefore, in deciding the type of reflector to employ, one must use a certain amount of judgment. Generally, the higher the units are placed the better, so as to avoid the lights coming into the direct line of vision to obviate glare.

Rating of Lamps.

The recognition of the measurement of "illumination," which is the effect of lighting, is gradually becoming an accomplished fact. But to be able to fulfil a specification of a certain foot-candle intensity of illumination, one must know, as well as the distribution of the unit, the actual candle-power values. There should be a recognized standard rating of lamps—a rating that should be accurate. It is perfectly clear that, should one have a fictitious candle-power value, the resultant illumination will not be accurate.

There is another greatly discussed point in connection with the rating of lamps. Makers usually rate their lamps according to the maximum candle power, in whichever direction it may be. It is well known that it is possible to get, by means of reflectors, a tremendous increase of candle power over a small zone in a vertical direction relative to the lamp; but it is certainly wrong to rate the lamp according to this maximum. Lamps should be rated rather by the quantity of light which they emit—*i.e.*, lumens (M.S.C.P. × 4π), or mean spherical candle power.

Measurement of Illumination.

The testing of the illumination values of actual lighting installations is an extremely easy matter; there being several very portable instruments on the market for this purpose. One of these is the "Holophane" Lumeter. [This the author proceeded briefly to describe.]

[The reading of the paper was accompanied by a large selection of slides—diagrams referred to by the author, actual installations of good interior and exterior lighting, and examples of wrongly and rightly placed lights. When Mr. Stroud resumed his seat, he was asked a number of questions by members on points that had been raised; and these he afterwards replied to at length.]

DISCUSSION.

The President (Mr. S. B. Chandler, of the South Suburban Gas Company) remarked that Mr. Stroud's name had recently appeared a good deal in the Technical Press in connection with lectures he had given, dealing with illumination problems, before the different Junior Associations. Their own was not the least instructive of the series.

Mr. D. J. Winslow (Lea Bridge) said it would be interesting to know whether Mr. Stroud had verified by actual tests on the Lumeter the calculations of the horizontal illumination by the cube of the cosine of the angle for the distances named, so that they could be sure the table worked out correctly. One was a little doubtful at times about relying too much on the results worked out by various angles, and so on.

Mr. F. Pearce (North Middlesex Gas Company), referring to the Lumeter, asked whether, in reading the number of foot-candles on (say) a table, it was necessary that the instrument should be held at any particular distance from the surface. It seemed to him there must be a difference in the reading, if the instrument was first held 2 feet away, and then moved to 10 feet. If distance did not matter, it seemed to him a very simple method of estimating the amount of light.

Mr. F. C. Briggs (Gas Light and Coke Company) said that he thought most of them quite envied Mr. Stroud the interesting work he was in a position to do in connection with this subject. It seemed to him that one of the most interesting problems with which the gas engineer had to deal was the scientific treatment of illumination. To make a fairly accurate forecast of the illumination one was going to get under certain conditions, it was necessary to be dealing with a scientific unit. He heartily agreed with the author in emphasizing the necessity for polar curves. He wondered why the manufacturers of lamps generally did not give them. Firms who did do so, were helping gas engineers very much indeed. He would like to know something about the actual amount of light absorbed by the type of fitting which had a prismatic bowl below the light.

Mr. W. L. Westbrook (North Middlesex Gas Company) agreed that the higher the unit of light was placed the better, so as to avoid the trouble of direct glare in the eyes. If, however, Mr. Stroud was going to provide a certain amount of illumination, so many foot-candles, on the working surface, he might have to consume an extra amount of gas or current if he used a different type of reflector and placed the unit higher.

Mr. Pearce, alluding to the question of polar curves, pointed out that, if two different mantles were taken, although they were made by the same manufacturer, they did not necessarily give the same illuminating power. Again, the quality of the gas might vary from day to day. A lamp might be tested one day with a certain gas; and then on the next occasion when it was tested, perhaps the gas would not have quite the same calorific value. He did not know whether any allowance was made for variations of this kind. It seemed to him an important point, because results might differ widely.

Mr. D. C. Cross (Lea Bridge) inquired whether, when using the Lumeter, one would get the same result if reading the illumination the same distance away from a light (say) on a blackboard and a white sheet.

The President said the paper had shown them what enormous strides had been made during the last few years in the scientific application of illumination. Mr. Stroud had given them some interesting data, and no doubt assisted to clear up many little points which had arisen in their minds from time to time. To him (the President) the term "candle power" had always appeared to be rather vague. It was difficult sometimes to know what makers meant when they talked of a certain burner or lamp emitting so much candle power. It was therefore desirable some general agreement should be come to on the subject of the rating of lamps by the quantity of light they emitted—lumens or mean spherical candle power. But, better still, he agreed with Mr. Briggs when he said that a polar curve should accompany the description of a lamp. A long time ago, he (the President) put forward this suggestion in a paper which he read. Unless the statements of makers were backed up in some such way, it was impossible to know where one was. Of course, it must not be forgotten that the absorptive or reflective power of surrounding objects made a difference to the resultant illuminating power of the burner put in. There were, he thought, four very good rules which should always be adopted by those seeking to produce satisfactory illumination; and he might be allowed to quote them. In the first place, the working surface should always have the highest illumination. This was generally very well understood. Secondly, illumination should always be as uniform as practicable. In the third place, shadows should be avoided. Fourthly, glare should be obviated by means of efficient shades or else similar translucent appliances. They were much obliged to Mr. Stroud for his paper.

Mr. Stroud, in the course of his reply to the points raised in the discussion, said it did not matter at all what was the distance, when using the Lumeter, from which one peered at the standard card. The only thing which could interfere with the reading would be atmospheric conditions—such as fogginess of the air. The reading would, of course, be different on a black and on a standard card. The instrument was calibrated to a standard white card, which should not absorb any light to give accurate readings. They must have the polar curve. A unit should not be used unless its performance was known. When a person bought an article, he wanted to know what it would do; and with regard to the candle power of lamps, it was extremely important that there should be an accurate recognized standard of rating. A lamp at present could be rated at anything one liked. There was no law under which a man could be had up for calling a lamp 10,000 candle power if it was 10 candles. Unless they could get actual rating of lamps, it was impossible to secure definite illumination. He had been asked a question as to the absorption of light by the use of the bowl type of reflector. With the particular prismatic bowls in the lighting installation he had shown, the absorption was about 15 per cent. To speak of absorption by itself was, however, most misleading. If one was getting 50 per cent. of light where it was not wanted, it was being wasted anyhow. If a light was covered by a reflector or shade, a certain obscuration resulted; but there was certain work being done by the shade. If the shade was raised 2 feet above the source of light, there was no absorption; but the shade was not doing any work. Whatever reflector was used, its performance—that was, its polar distribution—must be known. For different heights from the working surface, different types of reflectors would be used to secure the required result. The four lighting rules given by the President were very good ones.

The proceedings concluded with a hearty vote of thanks—proposed by Mr. Briggs, and seconded by Mr. Kemp—to the author and to his Assistant, Mr. Tye.

THE CONTINUOUS MANUFACTURE OF AQUA AMMONIA.

The number of "Gas Record" [Chicago] for the 22nd ult. contained an interesting account by Mr. P. Plantinga, of Cleveland, Ohio, of the Gas Machinery Company's system of making aqua ammonia on a large scale from crude ammoniacal liquor—the plant operating with a minimum of purifying agents.

The author points out that aqua ammonia is made by absorbing ammonia gas, free from impurities, in distilled water. Commercial aqua ammonia has a specific gravity of ·898 or 26·4° Bé, and 100 lbs. of it contains 29·4 lbs. of ammonia (NH_3) and 70·6 lbs. of water.

If aqua ammonia is to be made on a large scale, the process must not only be continuous, but the apparatus must necessarily operate with a minimum of purifying agents and expense. The apparatus described requires (exclusive of the lime used for recovering the fixed ammonia contained in the crude liquor) only an exceptionally small quantity of caustic soda, oil, charcoal, and lamp black for the elimination of such impurities as cannot be automatically driven off by the apparatus itself.

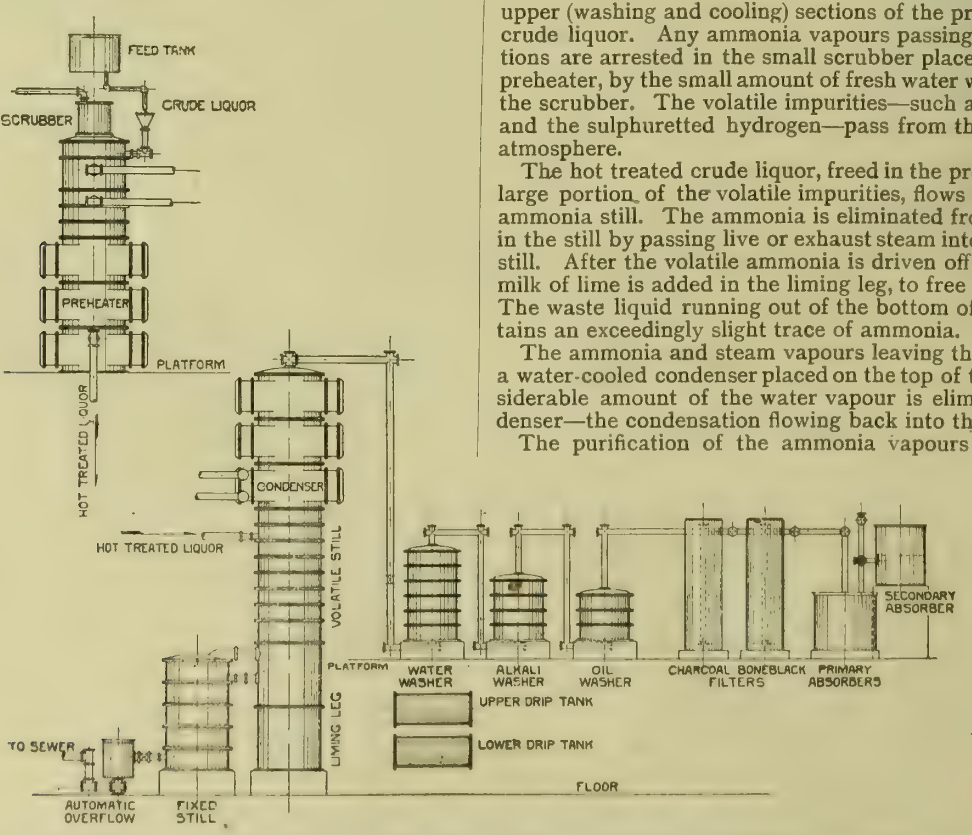
The illustration shows the general design of the apparatus, wherein the automatic elimination of the impurities from the liquor is based on the fact that carbonic acid and sulphuretted hydrogen are easily driven off in large quantities when crude liquor is heated to (or nearly to) its boiling point.

The machine operates as follows: The cold crude gas-works or coke-oven liquor is pumped into an overhead feed tank, from which it flows at a uniform rate into the top of the preheater. While passing down through the preheater it is heated by live or exhaust steam, which drives off the larger portion of the volatile impurities—such as carbonic acid and sulphuretted hydrogen. Some ammonia also is driven off; but this ammonia is caught in the upper (washing and cooling) sections of the preheater by the cold crude liquor. Any ammonia vapours passing through these sections are arrested in the small scrubber placed on the top of the preheater, by the small amount of fresh water which flows through the scrubber. The volatile impurities—such as the carbonic acid and the sulphuretted hydrogen—pass from the scrubber into the atmosphere.

The hot treated crude liquor, freed in the preheater from a very large portion of the volatile impurities, flows into the top of the ammonia still. The ammonia is eliminated from the crude liquor in the still by passing live or exhaust steam into the bottom of the still. After the volatile ammonia is driven off in the volatile still, milk of lime is added in the liming leg, to free the fixed ammonia. The waste liquid running out of the bottom of the still only contains an exceedingly slight trace of ammonia.

The ammonia and steam vapours leaving the volatile still enter a water-cooled condenser placed on the top of the still; and a considerable amount of the water vapour is eliminated in this condenser—the condensation flowing back into the top of the still.

The purification of the ammonia vapours is mainly accom-



CONTINUOUS AQUA AMMONIA APPARATUS FOR HANDLING AMMONIACAL LIQUOR.

plished in the water-washer. A small stream of fresh water is run continuously into the top of this washer, and forms aqua ammonia on its way down. The ammonia in the water-washer combines with the remaining carbonic acid and sulphuretted hydrogen contained in the ammonia vapours; and in this way these impurities are entirely eliminated. As considerable heat is evolved by the absorption of ammonia in the water, the water-washer sections contain water-cooled coils.

The overflow from the water-washer runs into the upper drip-tank, from which it is drained periodically into the lower drip-tank. From the latter tank it is usually run back to the crude-liquor tank or well, or the drippage is forced by compressed air into the preheater, where the larger portion of volatile impurities is again driven off.

The caustic or alkali washer is used for a safety or catch washer; a small amount of caustic soda solution being added periodically to arrest such impurities as may pass the water-washer accidentally. But an exceedingly small amount of caustic soda is required.

The oil washer is used for eliminating organic compounds; and fresh oil is seldom added.

Two filters, one filled with charcoal and one with bone-black, are used in series to remove the colouring matter from the ammonia gas. The charcoal and bone-black are seldom renewed. If the plant is to be operated continuously, two pairs of filters are installed with the required bye-pass connections to allow of one pair being kept in reserve.

There are two primary absorbers for the purified ammonia gas. While one is absorbing ammonia to make aqua ammonia, the other is emptied, and then filled with distilled water. To prevent any waste of ammonia, a two-compartment secondary absorber is provided; and the weak aqua ammonia formed in this absorber is drained periodically into the empty primary absorber. The absorbers are provided with cooling coils, as a great deal of heat is generated by the absorption of ammonia in water.

The aqua ammonia from the primary absorbers is usually temporarily stored in an aqua-ammonia storage tank; and, after being filtered, it is loaded into tank cars, drums, or carboys. The finished product is a water-white aqua ammonia, which not only fulfils the standard specification, but impurities are practically absent. It is, however, not chemically pure, as the aqua ammonia comes in contact with steel in the filters, absorbers, piping, and storage tank.

Excess Profits and Mineral Rights Duties.

A good deal of uncertainty exists as to the precise scope and intention of that part of the Finance (No. 2) Act, 1915, which imposes a new war tax in the shape of an excess profits duty. To remove this uncertainty, Mr. R. M. Montgomery, K.C., and Mr. William Allen, both of the Inner Temple, have written a book in which the chief provisions of the Act are clearly and concisely explained, and instructions are given as to how to find whether the profits of any business are liable to the duty, and, if so, the amount of the duty involved. This is followed by the sections of the Act, with notes pointing out certain difficulties which appear to arise in its construction, and the relevant cases. Under one section of the Act, there is imposed another duty, which is known as the excess mineral rights duty; and this is fully dealt with. The section [43] is a long one; and for its proper understanding, it is necessary to be acquainted with certain sections of the Finance Act, 1910, which are also quoted. There are no doubt many people to whom the book will prove useful; and they will find its value added to by the inclusion of a very complete index. "Excess Profits Duty and Excess Mineral Rights Duty" is published by Messrs. Butterworth and Co. and Messrs. Shaw and Sons, and the price is 7s. 6d. net, postage extra.

Testing a Surface-Combustion Furnace.

The Director of the United States Bureau of Standards has communicated to the Franklin Institute some notes from the recently issued annual report of his department, which, as usual, contains material of great technical interest to industries generally and to scientific laboratories. On the subject named above the Director remarks: In view of the fact that the surface combustion process appeared to offer many advantages for high-temperature laboratory furnaces, in which the Bureau is interested, it was decided to submit a crucible furnace of this type to a thorough test. For the purpose, the furnace was equipped with meters on the gas and air lines, and with a chimney to permit the collection of flue-gas samples. In several runs the mixture proportions were maintained constant, while varying the rate of gas consumption. Temperatures were read by a Holburn-Kurlbaum optical pyrometer. The highest temperature reached was 1675°, at which point the muffle failed. The test established that complete combustion could be attained without excess air; that the best air-gas ratio was 5·5; and that a 20 per cent. excess of air caused a lowering of the furnace temperature of 100°. An account of this test, which is the first of its kind, is in course of preparation.

Society of Engineers.—At a meeting of the Society to be held in Caxton Hall, S.W., at 5.30 next Monday, Mr. Percy Griffith will deliver his Presidential Address. The premiums awarded for papers read before the Society last year will be presented by Mr. Norman Scorgie, who was President for 1915.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

French Mask for German Pipes.

Sir,—I beg to inform you that your reference to my works, "*La Société Métallurgique d'Aubrives et Villerupt,*" as being controlled by Herr Thyssen, or any other German, is absolutely false. I have been closely associated with my Board of Directors for the past eighteen years, and regret to see you should have been so foolishly misled.

I am conferring with my works head offices in Paris, as to the best means of remedying the damage we may sustain by your publication.

54, Holborn Viaduct, E.C., Jan. 26, 1916. A. G. Cloake.

[The letter of "Anti Germanicus," which appeared last week, and which furnished us with the authority for some editorial remarks, was, we understand, based upon the book to which the writer of the letter referred—"L'Allemagne en France," by Louis Bruneau [Librairie Plon, Rue Garancière, Paris]. This book made prior publication of the statements to which exception is taken by Mr. Cloake; and it has been in circulation in this country through at least one well-known library. But, so far as we are aware, there has not been any attempt to cause the author of the book (which is in its fifth edition) to withdraw his assertions, or to suppress their circulation in France. We shall be glad to learn from the Company if anything has been done in this direction, because surely the source of any misstatement of which complaint could be made should have been before this dealt with in Paris, where, and not in this country, are situated, as our correspondent says, the "head offices" of La Société Métallurgique d'Aubrives et Villerupt. As to the "Journal" having been "foolishly misled," the letter of "Anti Germanicus" was published in the "Engineer" on Jan. 21—that is, before it appeared in our columns—and in the "Engineering Supplement" to "The Times." From this it appears that, if we have erred, it is in respectable company; but the blame must rest largely upon the negligence in Paris in not having prevented the continued dissemination of the information in the book written by Louis Bruneau. Our readers will note Mr. Cloake's denial as to the French Company having any German association in the matter of its direction.—Ed. J.G.L.]

Casting Pipes.

Sir,—With reference to the letter in your issue of Jan. 25, signed "Anti-Germanicus," we are surprised that any "M.Inst.C.E." should be so lacking in knowledge of the methods of British foundries.

We beg to say that this firm has been for many years making cast-iron socket-pipes, cast vertically, with sockets downwards, and a head-on spigot, and afterwards cut off in the lathe to ensure solidity, and has no means of casting them otherwise.

As to lengths of pipes, we have for some years been making pipes of 6 inches to 12 inches diameter (inclusive) in 4-metre lengths, and all other sizes (except 3-inch diameter) in 12 feet lengths.

The above disposes of your correspondent's reasons Nos. 2 and 3.

With regard to his reason No. 1, the cost must, of course, be considered not only as to price, but also as to relative qualities.

For James Oakes and Co.,
Queen Victoria Street, E.C., Jan. 26, 1916. F. Williams.

Gas Chemists.

Sir,—Now that gas chemistry is coming into its own, having almost attained the dignity of a separate profession, may I suggest that the time is ripe for the formation of a "Society of Gas Chemists"?

In these strenuous times, such a Society should prove of great benefit.

At present, gas chemists are scattered through the different societies like lost sheep; and besides the great advantage of discussing "shop" with "fellow sufferers"—union is strength.

Jan. 29, 1916. Agas Chemic.

Plymouth Corporation and the Watershed.—It is proposed by the Plymouth Corporation to purchase the fee-simple of the land constituting the watershed. The land is situated on Dartmoor and its border, and comprises 4891 acres. The owner, with whom a provisional agreement has been made, is Sir Henry Lopes. The whole of his rights are to be acquired in consideration of a perpetual chief rent of £825 per annum, which the Corporation may redeem at any time, on giving six months' notice, for the sum of £22,000. The Corporation will acquire properties yielding a rental on agricultural holdings of £631 with some apportioned rents for sporting rights and other minor properties. Sir Henry Lopes is allowed £125 per annum for a term of seven years for these apportioned rents; and the Corporation are to be allowed an easement for aqueducts or pipe-lines without payment for the land taken or damage through construction. The provisional agreement is subject to confirmation by the Council. Apparently it has arisen out of negotiations with reference to the laying of the new pipe-line which the Corporation are about to construct to increase the flow of water to the enlarged bore.

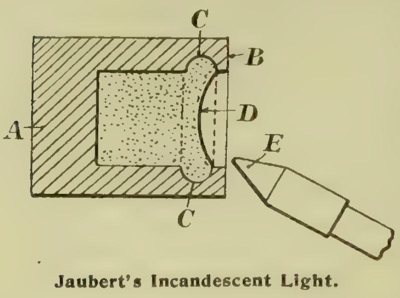
REGISTER OF PATENTS.

Incandescent Light Production from Rare Earths.

Jaubert, G. F., of Paris.

No. 23,443; Dec. 2, 1914.

This invention relates to a compound of rare earths for producing incandescent light by means of blow-pipes using mixed gases—such as oxy-acetylene, oxy-petrol, oxy-ether, and the like.



Jaubert's Incandescent Light.

The device shown consists of a hollow receptacle A of carborundum, alundum, or other refractory earth resisting very high temperatures. Formed in proximity to the edge B, with a circular groove C, the interior is filled with a compound of rare earths, the constituting elements of which are oxide of thorium, oxide of cerium, magnesia, and lime in different quantities according to the kind of light it is desired to obtain. The compound is provided with a small quantity of an alkaline polysilicate (such as powdered glass) intended to fulfil the function of a flux, and especially to produce, when in contact with the flame of the blow-pipe, the very rapid hardening of its external surface.

The following percentage proportions have been found good: Oxide of thorium, 92; oxide of cerium, 2; magnesia, 2; lime, 1; flux (ground glass), 3. The mixture is placed in pulverulent form in the container A with its surface formed concave as a D.

The advantages and features of the compound are said to reside in the incorporation of the flux in the mass, the effect of which is that, as soon as the compound is exposed to the flame of a blow-pipe E, it permits the rapid hardening of the external surface D, which is succeeded by the illumination. Also, in order to regenerate the surface D after prolonged use, a small quantity of the powder composition is spread over it and exposed to the flame of the blow-pipe.

In this way a "simplified and highly efficient compound of rare earths for the production of incandescent light" is claimed to be obtained, and "a simple and efficient device for using the compound."

Liquid Meters.

Hamill, W. W., of Glasgow.

No. 245; Jan. 7, 1915.

This invention relates to meters of the type in which a vane or the like is arranged in a channel through which the fluid is directed; the vane blocking the channel to a more or less extent and being displaced along the channel by the force due to the flow of the fluid. It relates to the variety in which the axis of the channel and the path of the vane lie in an arc of a circle, and in which the fluid is deflected by the vane out of the channel into a discharge chamber.

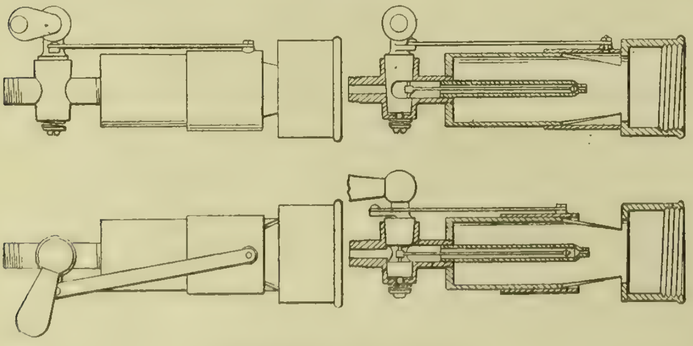
The invention consists in a construction of a meter in which the vane is arranged obliquely across the channel in a manner to deflect the liquid towards a slit connecting the channel with the discharge chamber, and the provision of a main chamber inside (or mainly inside) the channel—the vane being supported on an arm which passes through a slit connecting the main chamber with the channel. The slit is covered and closed by a drum, disc, or annulus pivotally supported within the main chamber and carrying it within the indicating means.

Gas and Air Mixing Device.

Hale, S. H., of Kansas City, U.S.A.

No. 1944; Feb. 6, 1915.

In this device for mixing gas and air the gas is controlled by a needle-valve capable of adjustment with regard to its seating and associated with the plug of the tap in such manner that the turning on and off of the tap produces a longitudinal movement of the needle. In this way, the quantity of air required for admixture with the gas may be admitted in a predetermined proportioned value.



Hale's Gas and Air Mixer.

The device comprises (in combination) a plug cock for controlling the main volume of gas, a needle valve for controlling its emission across an air space, and a sliding sleeve for regulating the extent of opening for the air to such air space—the whole connected together in such a manner that the rotation of the plug cock produces a longitudinal movement of the needle valve and sliding sleeve.

An illustration is given of a side elevation and plan of the device; also longitudinal sectional views showing the cock valve and sleeve in their closed and open positions.

From these it will be seen that there is provided a gas-mixer wherein the gas and air will be effectively mixed and the amount of air mixed with the gas be increased or decreased as the quantity of gas is increased or decreased. The device is so constructed that there are two valves—one in the pipe and one in the nozzle—which will both be seated at the same time to prevent any escape of gas. The stopcock or valve in the supply pipe will open slightly in advance of the opening of the valve in the nozzle, so that the full pressure of gas will be behind the valve in the nozzle, before it is unseated, and thus upon its unseating the gas will be ejected from the nozzle under full pressure.

Gas-Fires.

Valentine, H. S., of Glasgow.

No. 3095; Feb. 26, 1915.

This is an improvement upon the methods of fitting gas-fires like those described in patent No. 1524 of 1913.

As then proposed, a back plate or frame was provided for the reception of the gas fire, adjustably secured in place in the coal-fire grate and to the exterior of the legs by lugs, and (or) to the bottom grating of the grate by an angle plate—removable and adjustable panels being provided which partially overlapped the legs and served to conceal the lugs or other devices securing the back plate or frame in place.

The present "more simple and more easily fitted arrangement" consists in providing the back plate with arms so arranged that when the "inset" fire is in place they bear against the interior surface or back of the existing grate instead of the exterior. It further consists in making the arms capable of adjustment to various sizes of grates, and also in providing adjusting means in conjunction with the arms whereby the gas-fire may be drawn into the fire place of the grate and caused to make a close fit with the "legs."

Ignition Apparatus of Gas-Engines.

Climie, William, Jun., of Port-Glenone, near Belfast, and Lees, W., of Glasgow.

No. 10,354; July 16, 1915.

This invention has reference to fittings adapted to suit various forms of sparking plugs; and it consists in constructing the insulators of the insulated electrode of ignition apparatus so that the installation will not short-circuit with damp; while the plug can be either used as a low-tension or as a high-tension sparking plug by simply changing the return or uninsulated electrode from one form to another.

Gas-Heated Hand Irons.

Fletcher, Russell, and Co., Limited, and Banks, W., of Warrington.

No. 10,405; July 17, 1915.

In this arrangement the flexible gas-supply pipe is connected to the iron by an attachment adapted to swivel within suitable limits about a horizontal axis. It comprises a horizontally disposed nipple or nozzle provided with a lateral branch to which the flexible supply pipe is attached, and a bush, sleeve, or the like in which the nipple or nozzle is mounted so as to be capable of limited free angular adjustment or movement about its axis.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Jan. 26.]

Nos. 691—1063.

Adams, A. H. B.—"Reducing the lighting effect of lamps." No. 1057.
Askam, J. F.—"Gas-burners." No. 836.
Carpenter, H. A.—"Charging mechanism for gas-generating apparatus." No. 856.
Chandler, D.—"Gas-kilns." No. 874.
Cook, D.—"Gas ovens or furnaces." No. 737.
Cutler, S.—"Charging gas-retorts." No. 1047.
Fenwick, J. B.—"Hydraulic mains." No. 911.
Gallimore, J.—See Cook. No. 737.
Hall, A.—"Connecting branch pipes to main pipes." No. 1056.
M'Lachlan, R. W.—"Shade holders." No. 801.
Richard, V. H.—"Apparatus for cooking and heating by gas." No. 1006.
Riter-Conley Manufacturing Company.—See Carpenter. No. 856.
Riter-Conley Manufacturing Company.—"Charging and discharging retorts." No. 857.
South Metropolitan Gas Company.—See Chandler. No. 874.
Thomson, Limited, D.—See Cook. No. 737.
Ussher, L.—See Hall. No. 1056.
Warner, A. W.—See Carpenter. No. 856.
White, A. E.—See *Riter-Conley Manufacturing Company.* No. 857.
Yates, H. James—See Askam. No. 836.

Westminster Public Lighting Contract.—The Westminster City Council have been informed by their Special Committee on Reduction in Expenditure that the estimated charge for street gas lighting would, as the result of the new contract recently approved by the Council, be reduced from £13,000 to, approximately, £10,745—a saving of £2255 for a whole year, and of £840 for the current year. No saving had been foreshadowed in respect of the estimate of £23,500 for electric street lighting.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Sulphate of Ammonia.

Sir WALTER ESSEX on Monday last week, asked the President of the Board of Trade whether he was taking steps to ensure that the surplus of sulphate of ammonia over and above all home agricultural and munitions works' requirements may be equitably distributed among the buyers of neutral nations who had already made contracts for large supplies.

Mr. ACLAND (the Parliamentary Secretary to the Board of Agriculture) replied that it seemed quite possible that during the next few months there might not be any such surplus as that suggested. He hoped, however, to be in a position to make a statement as to the position of the Government with regard to the export of sulphate of ammonia before the end of the session.

Sir W. ESSEX asked the Minister of Munitions whether he was aware that the action of the Board of Agriculture, in totally prohibiting the export of sulphate of ammonia was likely seriously to diminish the output of T.N.T. and other materials necessary to the manufacture of munitions; and, if so, would he say what steps he proposed to take?

Mr. LLOYD GEORGE remarked that he was communicating with the Board of Agriculture on this question, with a view to reconciling the various public interests which were affected.

Last Thursday Mr. E. WASON asked the Parliamentary Secretary to the Board of Agriculture what steps, if any, had been taken to restrict or prohibit the export from this country of sulphate of ammonia, with the view of making certain the retention of a sufficient supply to meet the needs of British agriculture.

Mr. ACLAND said that the Board of Trade and the Board of Agriculture had, after consultation with the Ministry of Munitions, decided that for the present no licences for the export of sulphate of ammonia should be issued. It would not be possible to continue the withholding of licences indefinitely, as the normal production in this country considerably exceeded the consumption, and he ventured to express the hope that farmers would take this opportunity of securing ample supplies at the earliest possible date. Such a course would combine prudence with patriotism, and he confidently relied upon all agriculturists to adopt it.

Colonel YATE: Can measures be taken to reduce the price of sulphate of ammonia, which has gone up from £14 to £17 a ton?

Mr. ACLAND: The cost of production has also gone up very much, and I think a limitation of exports ought to be the surest way of securing that sulphate of ammonia shall be offered at a fair price to the farmer. The Government cannot hold out any hope of bringing down the price to anything like the pre-war level, or even to the level in the early part of the war, because the cost of manufacture has gone up very much.

Sir W. ESSEX: Has the fact been considered that the limitation made by this Order in the disposal of sulphate of ammonia will compel the producers practically to give a bonus to the farmers?

Mr. ACLAND: If it compels them to make reasonable offers to farmers, I shall be very glad, because that will be very much in the interest of the nation in encouraging and facilitating the production of food, which is a very important national object.

LEGAL INTELLIGENCE.

Conspiracy and Protection of Property Act.

At Hanley, before the Stipendiary Magistrate (Mr. Bertram C. Brough), Daniel Heath, a stoker employed at the Fenton Gas-Works, was summoned under the Conspiracy and Protection of Property Act, 1875, with breaking a contract which he had entered into with the County Borough Council. The facts which were disclosed during the hearing were that Heath was a good workman when he left alone the drink. On Dec. 24, he went to work the worse for drink, and failed to properly carry out his duties. Two days later, he sent a message to the gas-works saying that he would not be able to work that night. He was reported as being under the influence of drink while at work on Dec. 27; and on the following day he absented himself altogether, without giving notice. It was pointed out that if the other workmen had acted in the same way at Christmas, when the calls on the station were larger than at ordinary times, the supply of gas to the town would have been endangered. On two occasions when Heath had failed them, the foreman had worked all night; and the three other workers of the gang had been good enough to do his work as well as their own. The Stipendiary ordered defendant to pay a fine of £3, and £1 1s. costs.

Claim by a Gas Manager.

In the Reading County Court, last Thursday, before his Honour Judge Harington, Mr. S. W. West claimed to recover £10 10s. from the Twyford (Berks.) Gas Company, of which he had acted as Secretary and Manager. Plaintiff (who conducted his own case) maintained that when he left the employ of the Company, the Directors undertook to give him a "small honorarium," so long as they thought fit and he acted in a loyal and friendly spirit; and it was for this he sued. Cross-examined by Mr. Warren (for the Company) plaintiff said he continued in the service of the Company until March 25, 1914, and was paid in respect of that work, and also a half-year's salary (£35) from March to September of the same year, in consideration of his giving up the Secretaryship, and of assistance he had given to the Company. On July 1 the Directors wrote that they had not agreed to give him any honorarium; and he then replied that as he had been approached to interest himself in other means of lighting, he felt quite at liberty to consider his own welfare in the matter, as they had not offered him any hope for the future. In another letter he said he had no desire to be disloyal to the Company in any way, but could not study the Company's interests to his personal disadvantage. On Oct. 22 last, his successor wrote that the Directors were of opinion that he had rendered the Company no service, nor taken any steps in their interest to entitle him to consideration. He threatened County Court proceedings, and got a reply that it would be well for him to consider carefully whether the taking of such proceedings might render necessary a close examination of the Company's business for some years past. The plaintiff then had put to him a number of searching questions as to financial transactions. His Honour said the suggestions were very serious; and he asked plaintiff if he could explain how it was, in one case named, that he had collected £7 3s. 9d., and only paid in £5 17s. 3d. Plaintiff replied that he was very sorry he could not explain it. The whole thing was a mystery to him; and probably books which would have explained matters had by this time been destroyed. Judgment was entered for the Company, with costs.

A Disputed Wet Meter Registration.

At the Lincoln City Police Court, last Tuesday, John Roberts was summoned for failing to pay a gas bill for £3 11s. 5d. He admitted not having paid the bill, because he disputed the quantity of gas alleged to have been used. Mr. Bagshaw, for the prosecution, said the meter had registered accurately; and tests made in accordance with the Sale of Gas Act had proved that it was reliable. It was, however, a wet meter, and defendant had a desire for a dry one. The Corporation had about 14,000 consumers; and it was impracticable for them to let each customer have the particular kind of meter he might desire. If defendant wanted a dry meter, he was quite at liberty to provide one himself. Three offers had been made to defendant to have the meter tested, upon the usual terms; but he had not accepted them. As he would not pay for the gas consumed, the supply was cut off, and the meter taken away. The variation allowed by the Act was 2 per cent. in favour of the seller, and 3 per cent. in favour of the consumer. The meter had been found to be 1·5 per cent. against the defendant. It did not, however, follow that he was charged for more than was supplied. The meter was over a copper, and the water evaporated, which would be in favour of defendant, as also the fact that the house was on the hill, and would have increased pressure in the pipes. The probability was that he had had more gas than he was charged for. As to the question of a leakage, if there was one in the inlet-pipe the gas which escaped was not registered. Defendant said he had offered to pay half the amount claimed, and have a new meter; but the Gas Department had not accepted this. The Corporation claimed for nearly 13,000 cubic feet of gas, whereas he had not used 5000 cubic feet. The Magistrates found that the meter supplied by the Corporation registered correctly, as was proved by the official tests. With reference to any leakage, it was defendant's duty to attend to this; and the onus did not rest with the sellers of the gas. There would be an order made for payment of the amount claimed.

Lancaster's Good Character.

When moving the confirmation of the minutes of the Gas Committee at the monthly meeting of the Lancaster Town Council, Alderman Sir N. W. Helme remarked that it would be satisfactory to the Council to know that in the difficult conditions of finance in the country, they had secured the assent of the Local Government Board to proceed with the raising of the necessary money for the supply of gas to the new works and houses for workers. He had personal intimation from the Board that it was because of the sound system of finance that the Corporation had for many years applied to the gas undertaking that it was felt the unusual course could be allowed of anticipating parliamentary powers. The Provisional Order would no doubt receive sanction; but for the moment the Corporation had the assent of the Board to proceed. The policy of the Committee had been to strengthen the financial condition of the concern; and in the future they must endeavour to build-up the reserve fund by avoiding the application of the whole of the profits to keeping down the rates. The reason for the establishment of water-gas plant was that the supply of gas might be immediately increased. Ordinary plant could not have been erected until well on in the summer; and this would have deferred the supply of the increased amount to the new works. It was proposed to produce by means of the new plant half-a-million cubic feet of gas per day, or one-third of the production. It was hoped by this means to avoid any shortage of gas in summer. Alderman Bowness said they should congratulate themselves upon having earned such a good character.

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Municipal Profits and the Birmingham Rates.—The Birmingham trading committees have been considering what amount to offer the Finance Committee in relief of the rates; and, though a certain secrecy has been maintained, it is believed that the total amount will be about £100,000. The local "Post" credits the Gas Committee with a proposal to give £25,900, the amount of their original offer last year. On that occasion they were pushed up to £37,350; "and it may be that this time they will eventually increase their final offer to a somewhat similar sum."

Pudsey Gas Company.—The report for the year ended Dec. 31, to be submitted at the annual meeting of the Company to-day, states that, though the restricting of public lighting materially affected the sales of gas, private consumers made good a great portion of the deficiency. Contracts for coal were made at 5s. per ton advance on the previous year's prices. The Directors had been able to combat the large increase in the cost of coal and wages without advancing the price of gas. The Board recommend a dividend for the past half year at the statutory rate of 9 per cent. per annum. The expenditure was £20,219. Sales of gas realized £17,374, residual products £7808, and the profit for the year was £6194.

MISCELLANEOUS NEWS.

ELLESMERE PORT GAS ARBITRATION.

Fourth Day (*continued*).

A report appeared in last week's "JOURNAL" [p. 212] of the case for the claimants in the arbitration between the Ellesmere Port and Whitby Urban District Council and the Shropshire Union Railways and Canal Company, to determine the price to be paid by the Council for the Company's gas undertaking. Subsequent proceedings at the Surveyors' Institution, Great George Street, S.W., are now reported. The Arbitrator was Mr. A. J. RAM, K.C.

Mr. HONORATUS LLOYD, K.C., and Mr. A. M. PADDON (instructed by Messrs. Potts, Potts, and Gardner) appeared for the Shropshire Union Company; and Mr. W. E. TYLDESLEY JONES (instructed by Messrs. Baker and Sons), for the Ellesmere Port Council.

THE CASE FOR THE COUNCIL.

Mr. TYLDESLEY JONES, before proceeding to call evidence for the Council, addressed the Arbitrator. He said the claim was for a total sum of £54,891. This claim was put forward in respect of an undertaking which Mr. Woodall had valued on a constructional basis—that was to say, not merely the present value, allowing for depreciation, but what it would cost to construct the undertaking new at pre-war prices—at £14,695. His total value was £16,540; but this included a sum of £1845 for services, lamps, and meters on the Company's premises which it was admitted were not included in the present sale. To construct this undertaking before the war at normal prices would have cost £14,695; and the Council were being asked to pay for it the sum of £54,891. When such a claim was put forward, it was but natural that those who were acting on behalf of the Council should view the matter with some alarm, and try to bring out all the facts. He fully agreed that there were special features in the case which differentiated it from the ordinary class of arbitrations. Generally it was a question of an undertaking which was being bought out and out as a single entity, where the whole property of the Company was being sold and purchased, and where one proceeded upon certain well-known principles to arrive at the value of the business undertaking which was being transferred. What was done was to take the revenue-earning capacity of the thing which was being sold, and capitalize this; and the purchaser accordingly paid to the vendor the fair value of that which he was taking from the vendor, and which, ordinarily speaking, he was getting. One remarkable feature of the present case was that the Arbitrator was being asked to arrive at a sum which the Council were to pay for the undertaking included in the present sale by capitalizing a profit of nearly £400, which, in fact, had never been made, but which the vendors said they ought to be treated as making out of the undertaking; and the Arbitrator was to order the Council to pay 22½ years' purchase of this profit of £400. The extraordinary feature of this was that the very day after the sale was completed, the Company would be entitled to put up their own little corrugated iron sheds, and begin supplying themselves again, and earning for themselves their profit, which, in fact, they never had earned, but which they said they were to be treated as earning. In other words, the Arbitrator was to treat them as selling to the Council in this case a revenue of £400, though the Company could to-morrow retain this revenue in their own hands by carrying on a small gas undertaking for themselves and supplying themselves—not taking a single cubic foot of gas from the Council who were purchasing the undertaking. Now, what was the agreement in this case? It was an agreement which was entered into before the war, and it imposed on the Council certain very onerous conditions, which the Company were entitled to exact. But it was an agreement which required very careful consideration, to see exactly what it was the Council were to buy. What the Company agreed to sell, and what the Council agreed to buy, was the gas undertaking carried on under a particular section of the Act as existing at a particular date. What was the undertaking which was carried on under the Act? For this, they must refer to the 1893 Act, section 60. At that date the Company had gas-works for the supply of their own premises, and supplied their own premises from the works: "The Shropshire Union Company may from time to time supply at and near Ellesmere Port gas not required for their own purposes to any local board, any sanitary authority, or to any company or person, and may recover the rents or sums of money from time to time payable in respect of any such supply. Provided always that the Company shall not, by virtue of the powers hereby conferred upon them, be deemed to be a company empowered by Act of Parliament to supply gas within the meaning of section 3 of the Gas and Water Works Facilities Act, 1870." So that for the purposes of this section, they were not to be deemed to be a company empowered by Parliament to supply gas. Notwithstanding that the Company had statutory powers for the supply of gas, this was not to prevent the Board of Trade granting a Provisional Order to somebody else for the supplying of Ellesmere Port. At that date, the Shropshire Union Company were carrying on a gas undertaking for the lighting of their own premises. That was the only legal power which they had prior to 1893 to manufacture and distribute gas. What the Act of 1893 did was to give them an area in which they could supply gas to other people. It was a separate undertaking, supplied from the old gas-works. This was the undertaking which was referred to specifically in clause I. of the agreement to purchase. The Company agreed to sell the undertaking carried on under that section, and the gas mains, fittings, meters, and the works, machinery, and apparatus used in connection with the undertaking. Now, they had certain works and plant which were used partly in connection with the undertaking carried on under the Act of 1893, and partly for their own purposes. The problem that one might have plant, buildings, and machinery used for the purposes of two undertakings, and the purchaser might be liable to pay for a portion of it only, was unfortunately incidental to questions of purchase. It was exactly what was specifically provided for in this agreement. He was bound to pay for the goodwill of the business which he bought, and which the Company sold; but he was not bound to pay for the goodwill of business which the Council did not get, and which the Company could not sell. No statutory company could contract itself out of its statutory powers. The statutory power of sale given to the Company here was the power to sell the part of the undertaking for supplying gas not required for their own purposes. They could not sell—they were not authorized to do so—the right to supply gas required for their own purposes. When one came to consider it, this was, of course, a perfectly reasonable proposition. It was inconceivable that the Company could have ever thought that the Council were going to pay them something over £8000 for a supposed profit from supplying gas to their wharves, leaving them free to give this supply the next day. And, of course, it was not what the agreement said.

The ARBITRATOR: May it not be that, although by section 60 there is a limitation to the power to sell gas not required for their own use, yet, once they have been established as a gas undertaking, the words "agrees to sell the gas-works undertaking carried on by the Company at Ellesmere Port under the powers conferred on the Company" are descriptive only, and they might as well be left out of the section. It would then read: "The Council undertakes and agrees with the Company to purchase, and the Company agrees to sell, the gas-works undertaking of the Company?"

Mr. TYLDESLEY JONES: If you omit the words—"under the powers conferred on the Company by section 60 of the Act of 1893," I agree there is nothing in my point. But the words were put in for a specific purpose. This question goes to the root of a very large part of the claim; and it is so important to my clients that they would desire, if you do not accede to my view, that you should make your award in the form of a special case. They are certainly not prepared to pay the very large sum of £8000, or something of that sort, without seeking to have it established beyond doubt that these words, which were inserted for a definite purpose obviously, which have the limiting effect, in our opinion, for which I am contending, and which do make the agreement a reasonable one, should have their natural and proper meaning.

Mr. HONORATUS LLOYD: Of course, the converse will apply, if you propose to adopt the view of my learned friend.

Mr. TYLDESLEY JONES: Then, we are agreed in asking you, if you will, to state your award in an alternative form.

The ARBITRATOR: I am glad to say that doing so will save me a great amount of responsibility.

Mr. HONORATUS LLOYD: This might have the effect that I should have to claim for the destruction of my works, rendering it impossible for me to furnish my own supply, because you see by the next clause they have to remove the works.

The ARBITRATOR: You have to remove under section 2 the plant included in the purchase. Whether your contention is right or wrong on other points, is not this broad enough for you to say whatever purpose they may be used for, and in whatever proportion for the public or for the Company, if they are used in connection with the undertaking they have to be sold, and if they have to be sold they have to be removed?

Mr. TYLDESLEY JONES: I do not assent to that.

Mr. HONORATUS LLOYD said he would like to submit evidence on the point of what compensation he would be entitled to, if Mr. Tyldesley Jones's contention was upheld. He would lose his works, and be unable to supply gas to the premises.

Mr. TYLDESLEY JONES (resuming his argument) contended that 1913 was not a proper year to take for the accounts. The year 1914 was fairer, as it reflected conditions which would be continued for some time after the war, and some of the results of which would continue for the rest of their lives. As to the public lighting, no man would have assumed, if he were going to buy this undertaking, that the price for public lighting, which was fixed as long ago as 1907, would have remained after 1914 at the same price, if the Local Authority had the right (as they had) to determine the agreement. Therefore he said the price for the gas taken for public lighting was not the price which could be anticipated in the future, but something less.

Fifth Day.

Mr. TYLDESLEY JONES, continuing his argument, remarked that if it was going to be said that the price of 3s. 6d. per 1000 cubic feet for the supply to the public lamps, including the excess gas alleged to have been given, was a reasonable price, and so the Council would never have got a reduction, then it would be material for him to show that the alleged excessive consumption did not rest on any sure basis. The fact of excessive consumption was not admitted by him. Further, he maintained that the price of public lighting would not have remained at 3s. 6d., and that the time for revision had arrived. The agreement provided for 4½ cubic feet of gas per hour; and, of course, if the Company could show that the Council had been burning more, they were entitled to make them pay for it. Even if he were wrong in his contention that the undertaking which the Council had to purchase was that for the supply to the public and not to the Company, he still thought no addition ought to be made to the figures for profit on the gas supplied to the Company. But if an addition were made, he certainly thought it ought not to be what the other side had suggested. Nothing, in fact, had ever been treated as a profit on this undertaking; it would have been taking money out of one pocket and putting it into another. In the matter of repairs, it was common ground between them that the figure charged in 1913, should that year be taken, of 2d. per 1000 cubic feet, was insufficient; and he would call evidence as to what might be regarded as a fair figure. A point had been raised as to what the Company could do with the purchase-money, when they got it. Well, some of the things owned by them were steamers. If they invested money in getting steamers made at the present day, the rate of interest they would earn would leave gas undertakings in the shade from the point of view of a remunerative return.

Mr. HONORATUS LLOYD: Will you give me the address of the people by whom you can get them made? I know of a gas company who would be very glad to have the address at this moment of the shipbuilders you refer to.

Mr. TYLDESLEY JONES: You know that the best gas stock can be bought now to yield 6 per cent. That, I say, is an indication of the rate of return which gas capital ought to be valued at. Continuing, he said that with regard to the number of years' purchase, there were two things he wished to refer to as bearing on the question of security. The revenue which was being valued here was the revenue derived from a gas undertaking which at present was not subject to any competition. The Council, however, had an Electric Lighting Order, which was granted in 1913; and if the Company had retained the undertaking, this might have been put into force. This was a matter which materially affected the question of the maintainability of the revenue. Further, under the Act of 1914, the Council were given powers to supply gas; and there was no section in the Act which said they were not to supply it in Ellesmere Port until this undertaking was purchased. They were given powers which could come into force at once. No doubt, there was a great deal in the retort which might be made that if they had not agreed to purchase the undertaking they might not have got their powers. When considering the exceptional character of the undertaking—that the Company were not bound to supply, and all that sort of thing—the Arbitrator must bear in mind that Parliament would not have left them undisturbed in this extraordinary position, with powers to supply people when they liked, and to refuse to do so when they chose. Parliament would not have allowed this state of affairs to go on indefinitely. Of course, they did give a proper supply; but what he wished to emphasize was that no importance must be attached to the suggestion that the absence of obligations in some way added to the value of the undertaking, and ought to be considered in the number of years' purchase. So far as an allowance for compulsory purchase was concerned, the Arbitrator was not, of course, debarred from adding anything. The agreement specifically stated that it was to be deemed a compulsory purchase. But he did say that in the circumstances of the case no addition ought to be made. In the valuations put forward for the Company, there was an item for surplus works; but his evidence would be that there was no such surplus. On the question of "severance," claim for compensation, and so on, he was going to suggest that the award should be stated alternatively on this point. If the Arbitrator was entitled to allow the Company compensation for severance, he wanted him to name a specific amount; and if he was not entitled to allow them this compensation, then that the amount was so much.

The ARBITRATOR: If I state my award in the form of a special case, I can see several very fine points that will possibly go up to the House of Lords.

Mr. TYLDESLEY JONES: My proposition to you is that you cannot allow anything extra, either directly or indirectly, for compensation.

Mr. HONORATUS LLOYD: There is an extraordinary thing about the agreement, and that is that, under clause 8, we have a right to put an end to it at any time. I am not sure that we shall not do it. The words are: "Or if the Council shall fail from any cause to complete the purchase within three calendar months from the transfer day"—which they have not done—"then in such case it shall be in the option of the Company to withdraw from this agreement."

Mr. TYLDESLEY JONES: We have under our Act full powers for the supply of gas in this district. We have our gas-works erected, and in a very short time we shall have our mains; and the immediate result of this would be that the Company's undertaking would be competed with at the expense of the rates.

Sixth Day.

EVIDENCE FOR THE DISTRICT COUNCIL.

Mr. *W. B. Keen*, who was the first witness called by Mr. TYLDESLEY JONES, said he had been through the accounts, and had agreed certain tables with Mr. Cash. He had not been able in any way to ascertain what the capital expenditure had been. No doubt, such capital outlay as there had been was treated throughout as a revenue expense of the Railway Company. This made it impossible to draw up a balance-sheet, which was very unfortunate. With regard to the residuals, to a very large extent these were taken by the Company, who fixed their own prices, though he did not suggest that the rates so fixed were not fair market prices. The prices were fixed before, and not for the purposes of, this arbitration. It was only for convenience of departmental figures that they needed to put a price on at all. There was no attempt to arrive at other than a fair figure. In 1914 there was a small falling-off of revenue as compared with 1913. The first-named year, he thought, was the fairer one to take, particularly as it contained about four months of war and eight months of peace. It appeared to him that, averaging these two periods, one would obtain a much sounder view of what the future for a great many years was likely to be, than by taking a year which was entirely pre-war. It was the usual thing for public lighting to be charged at a less price than private consumption; and if the Company had remained in possession, there would have been very great pressure put upon them to reduce the price—pressure which he scarcely thought they would have resisted. Whether the Council had to take the whole or only part of the undertaking, he did not think it right that anything should be added for profit on the gas the Company sold to themselves. There was no security that the Company would take gas in future from the Council; and if they did, no one knew now what they would have to pay for it. Mr. Cash had admitted there was no depreciation written off cookers; and he suggested 7½ per cent. on the reducing value. The effect of this was that one never wrote off the asset at all. Witness would rather have suggested 10 per cent. on the original value. Even if the cookers were nearly new, he did not think this should affect the annual charge. They had been shifted about a good deal. There were 151 of them purchased, and the number of services fixed was 286; so that practically one stove had done duty twice over. This all depreciated the stoves. The amount charged for rates in the accounts was quite insufficient. The amount charged in the accounts for management was also very inadequate. It was inadequate as representing the cost to the Company, and also as representing what would be a proper management charge for such an undertaking. He thought the sum they were now spending amounted to £440 a year. It would clearly not be fair to take 22¼ years' purchase for the undertaking. The number of years' purchase must, of course, have some relation to the value of money in the same class of investments; and while he did not express any view as to the number of years' purchase that should be taken, he was very strongly of opinion that the rate of interest on any securities which might be anticipated in the future should be taken as at least 1 per cent. higher than the rates which would have been anticipated in dealing with such matters before the war. The effect of this would be that where before the war 33⅓ years had been taken, one would adopt 25 years; for 25 years, 20 years; and for 20 years, 16⅔ years. It must be many years before there would be a return to anything like normal yields on securities. What the Company asked was to be paid the whole of their capital and 35 or 36 years' purchase for goodwill.

Mr. TYLDESLEY JONES: Is the claim for £1800 which is put forward under the head of "severance," in your opinion, quite reasonable in amount?

Witness: The amount is not reasonable in my view. The very basis on which it is claimed here that this undertaking can be worked at a moderate price, is that men having other duties, and forming a part of a very large staff, can be detached for a part of their time to look after the undertaking. It is one of the incidents of a large staff that you are able to absorb them for other employments. In my view, there is no basis for any claim at all.

Mr. HONORATUS LLOYD (in cross-examination): Now as to whether we should receive anything in respect of profit on the gas we supply to ourselves.

Witness: I have never known a case of a business sold where a claim was put in for loss of the advantages that the proprietor of the business derived apart from his profit earning.

The ARBITRATOR: With regard to the undertaking we have to deal with, the contention of the Council is that, though it is a profit-making concern so far as the sale to the public goes, it is not a profit-making undertaking, or ought not to be so regarded, with reference to the gas consumed by the Company. Have you, then, with regard to the gas so consumed, valued it on any other basis?

Witness: No; I have not, in fact, considered what would be a basis.

Would you agree that if the matter is to be severable in the way Mr. Tyldesley Jones indicated in his argument, and treated as in part a profit-producing company and in part not a profit-producing company, after you had arrived at the proper amount to be given in respect of the profit made, there ought to be some amount arrived at by some method with regard to the sum to be paid to the expropriated person in reference to the remainder?—I quite agree.

Cross-examination resumed: He did not know whether the 7½ per cent. depreciation on diminishing value for stoves, &c., was the system adopted by the Inland Revenue authorities. Of course, the agreement with the Inland Revenue people on the question of depreciation was a compromise arrived at particularly in view of the fact that it had been very difficult to get any depreciation at all; and it was highly probable that it was not, in consequence, put on the most scientific basis. Where there were no profits, he agreed that it was very difficult to say what rent a hypothetical tenant would pay; and this was one of the anomalies of rating law. But he certainly did not think that any rating surveyor or any rating authority would, in rating these gas-works, say they had got to add to the income of the Company the value of the benefit that accrued to them from getting their own gas at cost.

Mr. *William Newbigging* said he had made himself familiar with the agreement under which the arbitration was being held, and with the works of the Company. He inspected the works along with the other two engineers, Mr. Herring and Mr. Lees, who were going to give evidence. Witness had made a structural valuation of the works which was in excess of Mr. Woodall's; but his valuation of the mains was somewhat less. In the total, they agreed very closely. The case the Council were putting forward was that the undertaking which they had to buy was that authorized by section 60 of the Railway Company's Act of 1893—that was, the public supply undertaking and the gas-works, retorts, and things of that kind used in connection with it. It would be possible to remove from the works the proportion of retorts which were applicable to the public supply undertaking. There were certain difficulties which would crop up in the apportionment; but they could all be surmounted. He had valued the public supply undertaking on the basis usually adopted in cases of gas-works purchase. If the Council were right and there were two undertakings, and the Council were entitled to take away the public undertaking and the plant relating to it, leaving the Company with their undertaking and the plant relating to it, then, if they were entitled to compensation for severance, they would be entitled to make a claim for the increased cost of continuing to supply themselves with gas.

After further discussion between the Arbitrator and Counsel as to the construction of the agreement, the proceedings were adjourned.

Seventh Day.

A SETTLEMENT.

When the proceedings were resumed on Monday morning of last week no further evidence on behalf of the Council was called, but negotiations took place between the parties with a view to arriving at a settlement. At the conclusion of the lengthy deliberations,

Mr. HONORATUS LLOYD was able to make the announcement that an agreement had been come to; and this arrangement he asked the Arbitrator to adopt in making his award.

The following are the heads of the agreement.

1.—The Council and the Company admit and agree that the undertaking to be purchased is the public supply undertaking, but without any of the property of the Company on the Company's land; and that the purchase does not prevent the Company supplying gas for their own purposes.

2.—Possession of the property so sold to be given to the Council on the Council handing to the Company a mortgage of the revenue of the gas undertaking and district fund and rates to secure £28,000 and interest at 5 per cent. from May 14, 1915.

3.—The Company to retain all profits of the undertaking to the date of the Council getting possession; all necessary apportionments being made.

4.—Award for £28,000 and payment by the Council of £500 on account of the Company's costs. The Arbitrator's charges to be paid in equal moieties by the Council and the Company. The mortgage to be for six calendar months, and thereafter until called in by three calendar months' notice. The mortgage, in case of dispute, to be settled by Mr. A. C. B. Webb, of the Chancery Bar, and him failing by Counsel nominated by the Arbitrator.

Mr. Honoratus Lloyd remarked that the parties had settled in this way what might have remained a controversy for two or three years.

The Arbitrator said he was sure of that.

TOTTENHAM LIGHT, HEAT, AND POWER COMPANY.

Half-Yearly Report and Accounts.

In the report to be presented at the half-yearly ordinary general meeting of the Company next Saturday, the Directors state that the accounts for the six months ended Dec. 31 show that, after providing for interest charges, there remains a profit balance of £11,586. Adding the amount brought from the previous half year (£14,680) and deducting £1480, the cost of conversion of Consols into War Loan, the sum available for distribution is £24,787. The advance of 3d. in the price of gas on July 1 last reduced the full statutory dividend payable to 7⅛ per cent. per annum on the "A" stock and 5⅝ per cent. per annum on the "B" stock; and the Directors recommend the payment of the dividends, together with 5 per cent. per annum on the preference stock, which will together absorb £22,602, and leave £2185 to be carried forward to the next account. The sales of gas show an increase of 4·89 per cent. over those of the corresponding six months of 1914; and there has been an addition of 1687 to the number of consumers and of 7115 to the cooking and heating stoves in use.

The accounts accompanying the report show that the revenue from the sale of gas amounted to £134,122; rental of meters, stoves, &c., and the maintenance of incandescent mantles produced £31,011; residuals yielded £36,892; and the total receipts amounted to £202,317. The principal items of expenditure were: Manufacture, £124,263; distribution, £31,921; management, £6502—the total expenses being £185,718. The balance carried to the net revenue account is £16 626 (included in this item is £27, the balance brought from the electricity revenue account); and the total standing at the credit of this account is £24,787. The statements relating to manufacture show that in the half year 1,346,594,000 cubic feet of gas were made, and 1,171,289,000 cubic feet sold; the total quantity accounted for being 1,192,319,000 cubic feet.

The G. J. Eveson Coal and Coke Company, Limited, of Birmingham, have forwarded one of their wallets for Treasury Notes.

COLOGNE GAS UNDERTAKING.

Annual Report.

The report of the Corporation Gas, Electricity, and Water Works of Cologne for the twelve months ended March 31, 1915, has recently been issued; and we abstract from it the following particulars relating to the gas undertaking.

Both the gas and electricity works were greatly affected by the outbreak of war; but by the end of the period under review, the consumption of gas had attained the same level as in March, 1914. The scarcity of petroleum which ensued from the war caused a large access of new consumers to both the gas and electricity departments. In December, 1914, arrangements were made to let on hire, to consumers having ordinary meters, fittings and appliances for the use of gas—a privilege which had hitherto been confined to the users of prepayment meters. The Corporation took over from April 1, 1914, the gas-works of the suburb of Mulheim, which during the twelve months under review produced 147,167,070 cubic feet of gas.

The gas distributed in the twelve months amounted to 55,284,814 cubic metres [1,952,438,491 cubic feet], which is a reduction of 1·30 per cent. on the output for the preceding twelve months. The previous report—see "Journal," Vol. CXXXII., p. 274—recorded an increase of consumption of 5·32 per cent. The consumption of gas per head of the population amounted to 3471 cubic feet. The Ehrenfeld works manufactured 97·49 per cent. of the total output of gas; the remainder being made at the Kalk works. At the Ehrenfeld works, 64 per cent. of the gas was made in vertical retorts, and the remainder in inclined retorts. The Kalk works has two settings of horizontal retorts. The gas unaccounted for was 4·68 per cent. of the output. The average make of gas per ton of coal was 12,129 cubic feet in the inclined retort-settings, and 14,149 cubic feet in the vertical retorts. There were at the end of the financial year 14,936 public gas-lamps with 17,669 burners. The whole of these burners, with the exception of 28 in fire alarms, were incandescent burners, either upright or inverted. The use of distant lighting devices was extended, and at the end of the year about 9200 public lamps were provided with them—four systems being in use. The total number of gas-meters in use on March 31, 1915, was 64,022, as compared with 54,803 twelve months earlier. Of the meters installed at the end of the financial year, 4539 were prepayment meters. There were 8526 cookers on hire. The number of gas-engines supplied on March 31 last was 432, with an aggregate of 2650-horse power.

The Stockton Rural District Council last Wednesday decided, on the recommendation of a Committee who had had the matter under consideration, not to accede to a request by the Haverton Hill Gas Company for an increase in the payment for street lighting.

Intelligent Anticipation

¶ One of the principal difficulties arising out of the present industrial situation is that of the intelligent anticipation of trade requirements.

¶ The problem, however, must needs be faced; and with the new season fast approaching, the present is not a moment too soon to order DAVIS Cookers—*always safe stock*—for early or forward delivery.

The Davis Gas Stove Co., Ltd.,
The Gas Exhibition Salons,
60, Oxford Street, London, W.

CARDIFF GAS COMPANY'S REPORT.

The Directors of the Cardiff Gas Company, in presenting the statement of accounts for the year 1915, state that an interim dividend of 4½ per cent. per annum on the 4½ per cent. preference stock and 5 per cent. per annum on the consolidated ordinary stock having been paid for the half year ended June 30, they now recommend that a half-year's dividend to Dec. 31 on these stocks be paid at the same rate, less income-tax.

The abnormal industrial situation created by the war was further accentuated during a considerable portion of the past season by great scarcity of coal, accompanied by almost unprecedented prices. Not only has the crisis affected the coal market, but the advancement in prices has extended in every direction, thus causing considerable increase in the cost of production. Thanks to favourable contracts for coal and materials generally, the necessity to raise the price of gas did not become imperative until after Midsummer quarter day, from which date a further charge of 4d. per 1000 cubic feet was made to all consumers. The Directors will at the earliest moment reduce the charge. In the meantime, it is gratifying to report that the demand for gas, notwithstanding the restricted public lighting and drastic limitations in the hours of business, has steadily improved, and a larger sale is recorded than over any similar period. At the request of the Ministry of Munitions a special process to produce toluol and benzol has been brought into operation; and, as every additional cubic foot of gas made is directly to the advantage of munitions production, the increased output may be regarded as eminently satisfactory. Notwithstanding the unusually heavy demand for gas, the Directors have encouraged enlistment; a large proportion of the Company's employees having joined the Colours.

Recognizing the increased cost of living among those still engaged with the Company, the Board have made due provision by granting each employee a special war bonus on his wages. The replacement of obsolete retort-settings was completed during the year. Owing to war conditions, the construction of the new gasholder at Grangetown has been necessarily delayed. The work, however, is in an advanced stage, and it is hoped will be completed very shortly.

The gross receipts were £256,586, including £186,781 from the sale of gas, £25,346 from meter and stove rentals, and £43,255 from residuals. The working cost was £219,481, leaving a profit of £37,105.

No Cause for Cheaper Gas.—Under this heading, the "Daily Mail" says that, with reference to the suggestion of some local authorities that the price of gas should be reduced now that some of the constituents in its manufacture are abstracted for munition purposes, the Minister of Munitions points out that the process offers no attractions to gas companies, who have had to go to much expense in order to put it into operation.

LIGHTING OF RAILWAY TRAINS.

[From the "Engineer."]

In some of the daily papers there is, generally once a week, a column in which engineering subjects are dealt with, or are supposed to be dealt with, in a manner that can be understood by the man-in-the-street. In one such column recently there was an article* which began: "The recent Tyneside railway disaster furnishes still another tragic reminder of the danger of using gas for the purpose of lighting railway carriages," and continued: "Unfortunately, we have had accident after accident in recent years on our railways where the wreckage has been fired, to the unutterable agony of the imprisoned victims of the disaster, by escaping gas. After each of these holocausts there has been the usual official inquiry, and invariably the finding has been the same—namely, to the effect that the fire was caused by, or was augmented by, the escape of gas" The article then proceeds to anticipate that Parliament will take some drastic action in this matter, and decide once and for all absolutely to forbid the use of any gas-lit passenger rolling stock after a certain date. This, it is suggested, could be comparatively easily accomplished just now, seeing that the railways are under Government control, and the Government could assist in making the necessary financial arrangements to enable the change from gas to electricity to be made promptly. Finally, it is stated that it would be excellent, too, if Parliament could insist on the abandonment of wood for railway carriage construction, as metal coaches have repeatedly been proved to be far less liable to be smashed up in a collision or derailment.

In what we are about to say it must be understood that we have every sympathy with those who have suffered, either in body or mind, from the dangers to which they were exposed in such accidents as the Hawes Junction, Ditton, Aisgill, Quintinshill, and Jarrow, where fire followed the original disaster. But we have yet to be convinced that gas was, in any of these cases, the original cause of the conflagration; and it is even open to some doubt that it augmented any of the fires. Live coal from the fire-box is the more likely cause; and if that be so, the universal provision of electric light as a train illuminant will not prevent future fires. It is true that here are five cases—to which Grantham may be added; but they are spread over a period of ten years, and within that time how many serious wrecks have there been in which there has been no fire? Look at Salisbury (all gas lighted coaches) and Shrewsbury (the majority gas lighted) and, in particular, Weedon last year. We draw particular attention to the Weedon accident as it is not only recent, but was accompanied by the complete destruction of several gas-lighted coaches. The article we have already referred to says that "one can only assume that gas is still used for railway lighting purposes because it is cheaper to install than electricity."

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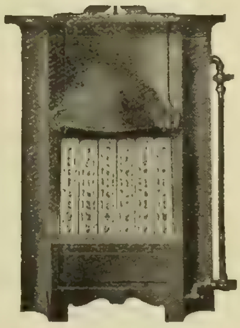
* The article referred to here is the one commented upon in the "JOURNAL" for the 11th ult., p. 74.—ED. J.G.L.

The MAIN D.S.O. Fires

"DEPENDABLE."
(Reduced Type.)

"SYMMETRICAL."
(Reduced Type.)



"ORIGINAL."
(Reduced Type.)

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Were this conjecture so worded as to suggest that the substitution of electricity for gas was delayed because of financial reasons, we would be inclined to agree. We think that, unless our railway directors can justify the expense of changing the system on all existing stock—because that is what is recommended—they would be failing in their duty to the shareholders, for whose property they act as guardians. Were the State to meet this difficulty by making "the necessary financial arrangements" (as is suggested), then it might be said that the State was undertaking an unnecessary work at the expense of the public. In dealing with new stock, it is a different matter. There is then no question of scrapping good material. And when new coaches are built, seeing that many of the public object to gas, the companies will do well to make this concession to their patrons. On most of our leading railways this is the policy pursued; and in the evidence given at the Jarrow Board of Trade inquiry, it will be seen that for the last three years all the new stock on the North-Eastern Railway has been fitted with electric light. It will also there be seen that this Company had under consideration, at the time the war broke out, the substitution of electricity for gas in all the existing stock. It may also be added, as an indication that railway directors do not let expense stand in the way of reform when they are satisfied that a change of policy is necessary, that the London and North-Western Company, as a result of the Ditton accident of September, 1912, ordered that all its gas-lighted stock should be provided with electric light within a period of ten years.

The article deals next with the question of fire-proof vehicles, and concludes as follows: People both speak and write occasionally as if the railway companies were careless about life and limb, and that the Board of Trade was needed to drive them to do their duty. Nothing could be further from the fact. Every accident damages the companies both in pocket and prestige, and if for no higher reasons, they would adopt every reasonable means in their power to reduce accidents to a minimum. We say without fear of contradiction that the splendid reputation of our railway companies has been won by their own effort, and not under the compulsion of a Government Department.

Gas Legislation in New South Wales.—In the course of a report to the Premier of New South Wales, the Under Secretary (Mr. J. B. Holme) says: "The Gas Act, 1912, aimed at giving to the community the benefit of (*a*) gas of the highest quality at the lowest possible charge compatible with reasonable profit, and (*b*) the best possible service of gas; and the results achieved have been substantial. The illuminating and heating quality of the gas now supplied cannot be seriously questioned, and the charges of the supplying companies in the Metropolis are now strictly controlled. The pressure in certain localities is not as satisfactory as it might be; but, generally speaking, it may be said that the consumers of gas are very much better off now that they have departmental protection than they were in the days of unlimited licence on the part of the gas companies."

EXTRACTION OF BENZOL AND TOLUOL.

No Attraction to Gas Undertakings.

At a Meeting of the Westminster City Council last Thursday, the Works Committee reported the receipt of a letter from the Ministry of Munitions, in reply to the Council's suggestion that an allowance should be made by the gas undertakings in respect of the extraction of benzol and toluol from gas.

The letter pointed out that the process in question offers no attractions to gas undertakings; and unless the experience of those concerns over which the Council have testing powers has been the reverse of that of almost all other undertakings, they have been put to a considerable voluntary out-of-pocket expenditure in order to put it into operation, in addition to the permanent cost of working. It was also pointed out that the previous circular which was issued by the Board had the unfortunate effect that it was bound to produce an exaggerated impression of the possible injustice to gas consumers. Incandescent burners depend on the calorific value of the gas; and flat-flame burners are now so few that probably less than 3 per cent. of the total make of gas in this country is used for its illuminating value. Yet a small lowering of this standard which the majority of undertakings are legally bound to maintain, by the process of the extraction of toluol, was the reason for the issue of the circular. The all-important calorific power is affected to a comparatively trifling extent.

In the above circumstances, the Committee stated that it is inadvisable to pursue the suggestion that undertakings should be required to make an allowance in respect of any deterioration of the lighting or heating qualities of gas consequent on the extract of benzol and toluol.

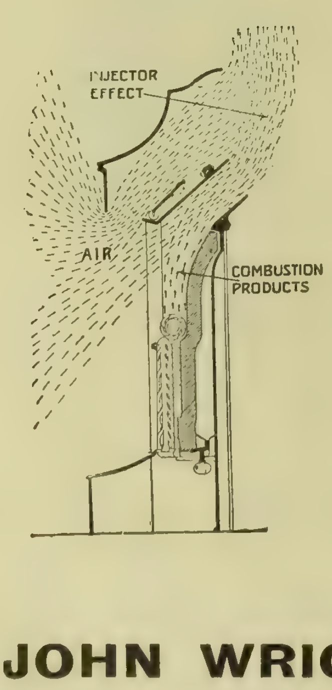
LIVERPOOL'S FIRST GAS SUPPLY.

[From the "Liverpool Courier" of Monday, Jan. 24].

Gas lighting in Liverpool has now been in operation for a hundred years. To-day marks the centenary of the system here. Some interesting facts relating to the subject were incidentally touched upon in a lecture recently given before a Liverpool Society by Mr. James M. Dow, on "Old Liverpool;" and these are very *apropos* to-day.

The idea of establishing a public gas supply for Liverpool, it appears, was started at a meeting held in the "Crown Inn," Redcross Street, on the 16th of October, 1815—a local tradesman, Mr. Varty, of Dale Street, being especially interested in the system. The outcome was the lighting of the first public gas-lamp, opposite to the Town Hall, on the 23rd of January, 1816; the supply being obtained from a small apparatus on the premises of Mr. Varty.

WHAT "THE LANCET" (JAN. 15, 1916) SAYS OF WRIGHT'S "INJECTOR-VENTILATING" GAS-FIRES



"In the earlier days of the gas-fire the system fell into disrepute on three counts: first, the combustion products did not entirely escape up the flue, but vitiated the air of the room to some extent; secondly, even when that was not the case there was no efficient ventilation of the room as there is with the open coal fire; and thirdly, the flames were irritatingly noisy. Until quite recently we have not examined a gas-fire which quite satisfied us on all three points. Messrs. John Wright and Co., of Essex Works, Birmingham, have introduced an 'injector-ventilating' gas-fire which shows that these essentials have received considerable attention, and the result is a very important gain to this system of heating by radiant gas-fires. This fire not only secures the complete withdrawal of the products of combustion, but by means of a second opening a powerful in-draught of air from the room is induced to flow up the chimney. This ventilates the room as effectively as the open coal fire, and a true atmospheric flame is secured which is constant in its character and unaffected by variations of pressure; above all it is silent. It is surprising to see a clean blue intense flame free from purring sound. This has been effected by bringing about a thorough mixing of air and gas by means of a perforated thimble dropped into the opening of the burner. This is provided with vertical perforations, and in ordinary practice it cannot be choked with grit. The purring is probably due to a rapid series of minute explosions resulting from an imperfect mixture of gas and air. At the same time there is an ingenious fitting which provides for initial pressure adjustment. Altogether, this fire marks a most important advance, and is calculated to remove what prejudices remain against the use of gas for the purpose of domestic heating."

JOHN WRIGHT & CO., ESSEX WORKS, BIRMINGHAM.

As in all important innovations affecting material progress, the beginning of the gas era in Liverpool caused both curiosity and perplexity. The public did not quite know what to make of it. Some, we are told, touched the pipe conveying the gas, to see whether the pipe was hot; while insurance directors were alarmed lest the use of gas would cause fires. Whatever prejudice may have existed, soon however disappeared.

On the site of this first local gas-lamp, and known as the High Cross, there had been established in 1651 one of the two public lanterns which were lighted in periods of dark moon. The other lantern stood on the White Cross, the site of which is now the entrance of Exchange Buildings—Old Hall Street end.

From these early beginnings and a somewhat primitive method, what an enormous development has taken place! Liverpool may now be said to be one of the best-lighted cities in the kingdom; and while due recognition is allowed for the great scope of the electrical illuminant, yet immense progress in gas lighting has been made. At present there are over 25,000 public gas-lamps in Liverpool, fed by 930 miles of gas-mains. The bodies first concerned with lighting were the Liverpool Gaslight Company, constituted by an Act of Parliament passed May 23, 1818, and a Company which was formed in 1822 for the production of gas from oil. These Companies amalgamated in 1848, hence the former title, Liverpool United Gaslight Company. From the inception of the original Gas Company to 1849 their offices were in Dale Street. In 1854 the premises were sold to the Corporation, and the present police offices stand on the site.

ITALY AND RUINOUS FREIGHTS.

In a letter appearing in the "Times" last Wednesday, Mr. George A. Touche, M.P., wrote as follows on the subject of Italy and ruinous freights:—

> "As a Director of an important French Gas Company, which has to export about 360,000 tons of coal annually to Genoa, I have had an unfortunate experience of the serious consequences of the rise in freights. These have increased from a pre-war rate of 8s. a ton to 90s. a ton. The commercial results of such exorbitant rates are disastrous; but the position has a much wider significance than the prosperity or injury of an important French industrial company, whose securities are held in this country and in France. The situation is fast becoming perilous from a political point of view. Gas is used for domestic purposes in thousands of homes in the chief cities of Italy. If its price is increased in proportion to the increase in the price of coal, and consequently in manufacturing cost, its use will be almost prohibitive. I have before me a letter from Italy which speaks in grave language of the effect on the Italian community of the enormous freights now demanded and obtained by shipowners for the conveyance of coal to Italy, and on Italian traders of the rate of exchange, which is now 32 lire for the pound sterling. Powerful influences are at work to foment discontent and ill-feeling, and to encourage a conviction among the Italian public that it would be better to return to the German alliance. To those who know something of the extent of Germany's financial penetration of industrial Italy before the war, the danger of the present situation will be obvious. The British Embassy is credited with knowing the situation on paper; but there is an impression that it possesses only a limited knowledge of the ideas and feelings of the mass of Italian traders and consumers. The activities of various Government Departments have not yet succeeded in producing any palliative for a commercial and economic situation between England and Italy which is becoming intolerable. The root of the evil appears to lie in a mishandling of the shipping problem, created by the shortage of tonnage. It is alleged and denied that there has been a wasteful use of ships in Government employment. One thing is clear: Present methods have failed, and we are heading for political as well as commercial disaster."

It may be remembered that when presiding, in the absence of the Chairman and Deputy-Chairman, over the meeting at the end of last year of the Continental Union Gas Company, Limited, Mr. Touche had a good deal to say on this subject, as reported in the "JOURNAL" for Dec. 21, p. 653.

GAS COMPANIES' POWERS IN QUEENSLAND.

A Bill to Limit Profits.

In the Legislative Assembly at Brisbane, early in December, Mr. Huxham (the Assistant Home Secretary) moved the second reading of a Gas Bill having for its objects: (1) To create a standard of illumination, heating power, and purity of the gas; (2) to provide for the testing of meters; (3) to make the installation of meters compulsory; (4) to regulate the price of gas.

In explaining the need for the measure, the Minister said that the profits of gas companies in Queensland had been exceedingly large; while many of the companies had increased their capital out of reserves. Even then large dividends had been declared. The Bill would, however, have the effect of limiting profits by providing a standard price and a standard purity. The companies had made enough money out of the public in the supply of poor gas at a high price; and it was time they were controlled. It was high time that the Government safeguarded the interests of the people, so that they should be given better gas at a cheaper price. This was no novelty. It should have been in existence many years ago, and it merely remained now for the Government to put it in operation as a duty to the public. The New South

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Wales Government had grappled with the gas monopolies, and even regulated their dividends by limiting them to 10 per cent. The result was, therefore, greatly beneficial to the people, who were able to obtain their gas at a considerably reduced price. The profits of the Wynnum Gas Company had been limited by a former Government, and all that remained to be done now was to extend this principle. The mains of the South Brisbane Gas Company had been almost renewed of late years, and yet they had maintained their high rates of profit. They had seen, too, that the Company had been extended to certain districts; but because the residents would not pay 10s. per 1000 cubic feet, the Company would not use the pipes. These extensions had cost upwards of £20,000; but no gas had passed through the pipes until the people agreed to pay the huge price demanded. Did this not merit interference? The community using the service in other districts had to bear this loss; but the Company saw to it that their dividends were maintained. They could not tolerate such a state of affairs any longer. The gas legislation in New South Wales had had most encouraging results. The Bill was not quite what he desired, but it was a step in the right direction; and the dog-in-the-manger attitude of the South Brisbane Gas Company in connection with the incidents at Sherwood and Yeronga would be stamped out. The measure would come into operation on Jan. 1.

NOTES FROM SCOTLAND.

Edinburgh Streets and Automatic Lighting.—It was reported in last week's "Notes" that, acting in conformity with the requirements of the Military authorities, it had been decided to make no change in the existing regulations as to the public lighting of Edinburgh. At a meeting of the Cleaning and Lighting Committee of the Town Council, however, held on the 24th ult., the question of automatically lighting and extinguishing the lamps was considered, and it was resolved to ask Messrs. Alder and Mackay, of Edinburgh, to fit up an experimental installation. If the experiment proves successful, it may lead to the adoption of the system throughout the city. There is a strong feeling that something should be done to remove the inconvenience, not to say danger, caused by many of the streets being in darkness; and the Committee are hopeful that the apparatus will afford the means of doing this. It was stated at the meeting that at Newcastle, Leeds, Ipswich, Bonnyrigg, and Haddington the method was in successful operation.

Coatbridge Gas Company.—An extraordinary general meeting of the shareholders of this Company will be held next Tuesday to authorize the raising of additional capital to meet the expenditure on the proposed introduction of modern carbonizing plant. Previous to that, however, the ordinary meeting will take place, when the Directors will submit the statement of accounts and balance-sheet for the year ended Dec. 31 last. The consumption of gas amounted to 235,714,057 cubic feet—being an increase of 957,140 cubic feet over the previous year. The gross revenue for gas, residual products, &c., was £45,854. Owing to the increased return from residual products, the Directors were able to reduce the price of gas by 3d. per 1000 cubic feet as from Jan. 1. They recommend dividends (in accordance with the sliding-scale) at the rate of £10 15s. per cent. per annum on the original stock, and of £7 10s. 6d. per cent, per annum on the three issues of £10 shares, less income-tax. The report mentions the sudden and lamented death of ex-Provost Sharp, the late Chairman of the Company, in August last, and states that the vacancy on the Board was filled by appointing Mr. Alexander Neilson, of the Dundyvan Iron-Works—Mr. Alexander S. Legat being appointed Chairman.

Perth Gas Difficulties.—Referring to the troubles at the Perth Gas-Works, of which notice has already been taken, the "Dundee Advertiser" states that in municipal circles it is realized that recent recurring shortages of the gas supply and complaints as to its unsatisfactory character are less serious than the financial questions involved in effecting improvements in the supply. The revenue account shows that the current year began with a deficiency of £371. That considerable outlays on the plant at the gas-works will shortly have to be made is, it is added, certain. "Though authority has been granted to borrow from the bank up to £10,000, it is clear that, even if only the half of this sum should be required, the interest on which may safely be taken as at 6½ per cent., it would amount to no less than £325 per annum. When it is considered that the capital account of the gas undertaking is represented by annuities, loans, stock, and bonds, amounting in all to £259,294, and the total revenue for last year, including £1465 from the burgh general assessment for public lighting, was £45,680, of which £13,368 was carried to the net revenue account for payment of annuitants, sinking fund, interest, &c., it will be understood that the financial problems involved in any alteration or reconstruction of the gas-works are such as will tax the abilities of the Town Council to the utmost to place them on a satisfactory footing."

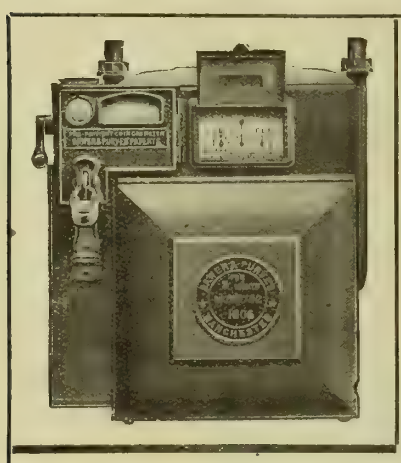
CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 31.

Tar products generally remain without change, and there is nothing of special interest to report. To-day's values are: Pitch, 19s. to 19s. 6d. per ton, in bulk; creosote, 4⅜d. to 4½d. per gallon, in bulk; 90/160 solvent naphtha, 2s. 2d. to 2s. 3d. per gallon, naked—all at makers' works, net cash.

The price of 25 per cent. sulphate of ammonia remains unaltered at £17 5s. per ton net, into buyers' bags, at makers' works. A fair amount of business is being done.



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Tar Products in the Provinces.

Jan. 31.

There has been practically no change in the market for tar products during the past week. As regards pitch, this article is still dull through want of getting tonnage in which to remove it, and in most cases prices are purely nominal. Creosote is dull and difficult to dispose of, as most of the works are beginning to be somewhat hampered by their stocks of it. Naphthas are in very good demand, though prices show a tendency to advance.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 3d. to 22s. 3d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10¾d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6¾d. to 7d. Solvent naphtha, naked, North, 2s. 1½d. to 2s. 2½d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅝d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4⅛d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, pure, £20 to £30; creosote salts, 90s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Jan.* 29.

In consequence of the further restrictions placed on the export of this material to foreign countries by the Board of Trade and the Board of Agriculture, the tone of the market has been depressed during the past week, and prices have been more or less nominal. The closing quotations are £17 10s. per ton f.o.b. Hull, £17 12s. 6d. f.o.b. Liverpool, and £17 15s. f.o.b. Leith. In the forward position, no fresh transactions have transpired, although there would be buyers abroad for February, March, and April shipment if it were possible to execute the orders in this country.

Manchester Tar Prices.

The average price realized for tar—based on the value of the products—for December deliveries, throughout the Manchester district, was 23s. 9d.

Nitrate of Soda.

This market has advanced still further, and the values on spot are now 16s. 9d. per cwt. for ordinary quality, and 17s. 9d. for refined.

Sulphate of Ammonia.

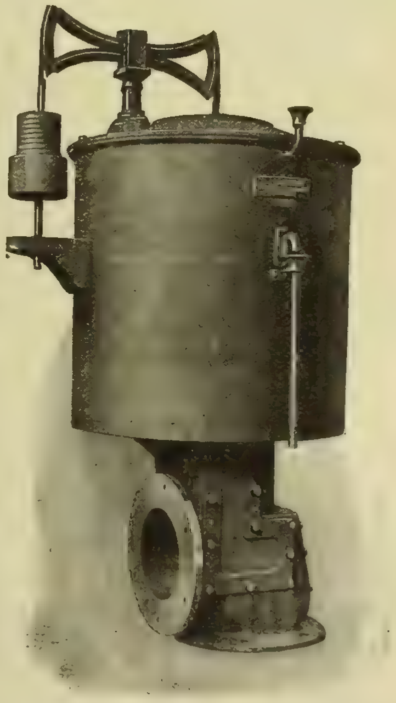
From another source, it is stated that there has been practically no change in this article during the past week, and prices remain as before. Outside London, makes are quoted at £17; Hull, £17 15s.; Liverpool, £17 17s. 6d.; Leith, £17 17s. 6d. to £18; Middlesbrough, £17 15s. to £17 17s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The briskness in the northern coal trade continues, and prices are firm, with an upward tendency in some cases. The shipments appear to be good; but these are largely on contract. For new orders, the prices are higher. In the steam coal trade, the strong position makes advances needful to be given when early loading is desired. Best Northumbrian steams are quoted from 25s. to 29s. per ton f.o.b., according to time of delivery; second-class steams are scarce at 23s. to 23s. 6d. per ton; and steam smalls are firm at 12s. 6d. to 15s. per ton f.o.b. The output is fair under the circumstances of the limited number of miners. In the gas coal trade, the quotations are a little higher—possibly because the margin of coal free for sale is now small, and there are Government needs in the market. Best Durham gas coals are 24s. per ton f.o.b.; second-class gas coals are 22s. per ton; and "Wear Specials" are firm at 24s. 6d. to 25s. per ton. The exports are steady, and there are fair shipments on account of the long contracts. It is said that Italian buyers are holding back, because of the high cost of coal and high freights. As much as 87s. is quoted for freight on gas coal, Tyne to Genoa; and the rate to London is near 15s. The delivered cost of the coal is therefore very great—to Italy especially—and even at these high figures, supplies cannot be considered full. Contracts are only slowly negotiated just now; the Government's purchases being full, both of steam and best gas coal, and the extent forward of such purchases is not easily foreseen. Coke is steady, with fair exports; but the production is heavy. Good gas coke is quoted from 27s. 6d. to 29s. f.o.b. in the Tyne, according to class. Home requirements of gas coke are steady.

Mansfield Coke Prices.—At last Friday's meeting of the Mansfield Town Council, Mr. Beazley inquired whether the price of coke had been fixed by the Gas Committee to purchasers outside the borough, and what it would be when the advance took place. The Mayor (Mr. T. Smith), who is also Chairman of the Gas Committee, said this was a question which it was impossible to answer. The Committee did not sell to anybody outside the town until Mansfield buyers had been supplied. There had been times when they could have obtained a far higher price outside than in Mansfield itself. At present, the Committee had one contract at 16s. 3d. a ton—much more than they obtained locally. It would pay them now to cut off Mansfield supplies altogether. They had been in a position to get close on 30s. a ton from outsiders.



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An Old Bradford Holder.

The seventy-year-old gasholder which is being dismantled at the Bradford Corporation Thornton Road gas-works [to which reference was made last week in our report of the Yorkshire Junior Gas Association meeting] has created considerable public interest locally, since the visit of the Yorkshire "juniors" called attention to the affair. Though its design is now completely obsolete, it was in its time probably one of the largest holders in the country. It had a capacity of between 80,000 and 100,000 cubic feet, as against a capacity of 700,000 cubic feet of the newer holders alongside of it. The dismantling has disclosed, in addition to the peculiar wooden umbrella-like strutting, the exceptionally fine quality of the metal outer plates, which were made of local Bowling iron, the best obtainable at the time. In the days of the erection of the holder, the gas was sold at about 5s. per 1000 cubic feet, as against Bradford's normal price of modern times of 2s. 1d.—though it is up, owing to war exigencies, to 2s. 6d. The holder was built in 1846; but gas had been used in Bradford 23 years before, having been made in a brick oven, before the time of the iron retorts. In those days, the charges were 25s. per burner per year; the lights to be extinguished at 9 p.m. In 1827, the consumers were paying 13s. per 1000 cubic feet.

* * *

Guiseley Water-Works Purchase Question.—The Guiseley District Council have been in committee to hear a report by a deputation who interviewed the Guiseley Water Company with a view to the purchase of the undertaking by the Council. It is understood that, as a result of the meeting in committee, the Council decided to purchase, subject to the approval of a general meeting of the shareholders and of the Local Government Board.

Durham City Gas Company.—The annual report of the Company, issued last week, shows that, after deducting the interim dividends for the half year ended last June, there is an available balance of £3382. The amount required to pay the ordinary dividend (less tax) is £2420. This leaves a net balance to carry forward of £961, which the Directors consider very satisfactory in view of the existing state of things. A dividend of 5 per cent. on the original and 3½ per cent. on the additional capital is proposed for the half year; making 10 per cent. and 7 per cent. respectively for the year.

Gas and Electricity Works Joint Management.—A lengthy discussion took place at a special meeting of the Abertillery Urban District Council, on a suggestion that the electricity undertaking should be under the control of the Manager of the gas-works (Mr. E. D. Wootton); Mr. Dan Lloyd, who had been in charge of the electricity works since they started, having accepted another appointment. For some years there has been a feeling that it would be a good thing if both undertakings were under one management; and it was thought that the resignation of Mr. Lloyd afforded an opportunity to give a trial to the proposal. It was stated that both undertakings would have to be kept financially independent of each other to comply with the requirements of the Board of Trade, &c. The Council decided to make a six months' trial of the proposal for joint management; and this will involve also the merging of the Electricity Committee into the Gas Committee.

Economizing at Llandudno.—At the monthly meeting of the Llandudno Urban District Council, Mr. Pierce Jones moved that all the street-lamps should be lit which could be lit without a breach of the regulations under the Defence of the Realm Act. Mr. David Davies seconded, submitting that in using gas they were complying with the wishes of the Munitions Department by increasing the supply of residuals for the manufacture of high explosives. Mr. W. Thomas, the Chairman of the Gas Committee, said they were complying as well as they could with the request of the Prime Minister to be as economical as possible of the gas-lamps in the town. Of these, 120 were lit and 340 were not lit; and at the end of the financial year he hoped they would have saved £238 in the public lighting. At the same time, wherever a lamp seemed necessary for the public safety it was lit, and the people generally were getting accustomed to the dim lighting of the streets. The motion was defeated by a large majority.

Hull Water Supply.—The Hull Water and Gas Committee will consider at a special meeting a proposal that no further increase in the number of outside taps should be allowed, and that as existing taps of this character become worn out, they should not be renewed except where they form the sole supply to houses. The Water Engineer (Mr. C. B. Newton) points out that the present population is about 300,000, and the daily consumption of water 12 million gallons. In about fifteen years, the population will probably increase to 400,000, and the requirements to 16 million gallons. In thirty years, the population will reach approximately 500,000, and 20 million gallons of water will be required per day. From these figures, he says, it will be seen that great demands will be made upon the source of supply. The average daily yield of the existing works in 1914 amounted to 11 million gallons; and when the Dunswell Station is completed, they might reasonably expect the yield to be increased to approximately 15 million gallons.

Lighting of Paignton.—The question of the lighting of the town was considered by the Paignton District Council at a special meeting yesterday week. By a rigid interpretation of the orders of the military authorities, stimulated by a desire for economy, the Council have for some time past ceased to light any of the public lamps. Mr. Vanstone, who had protested on several occasions against this policy as detrimental to the public interests, suggested that in the centre of the town every alternate lamp should be lighted from lighting-up time in the evening until 9.30 p.m.; and that controllers should be fixed to the lamps so that men would not be required to light and extinguish them. Mr. Smith proposed that consideration of the matter be deferred until August, when the estimates for the winter lighting would be considered. Mr. Ham pointed out that the Council were heavily in debt, and had no lighting rate; and the proposal would involve a capital cost of £300 or £400 to begin with. He did not agree that harm was being done to Paignton as a resort by the absence of light. The Council decided to hold another meeting in committee to consider the matter further and decide on a course of action.

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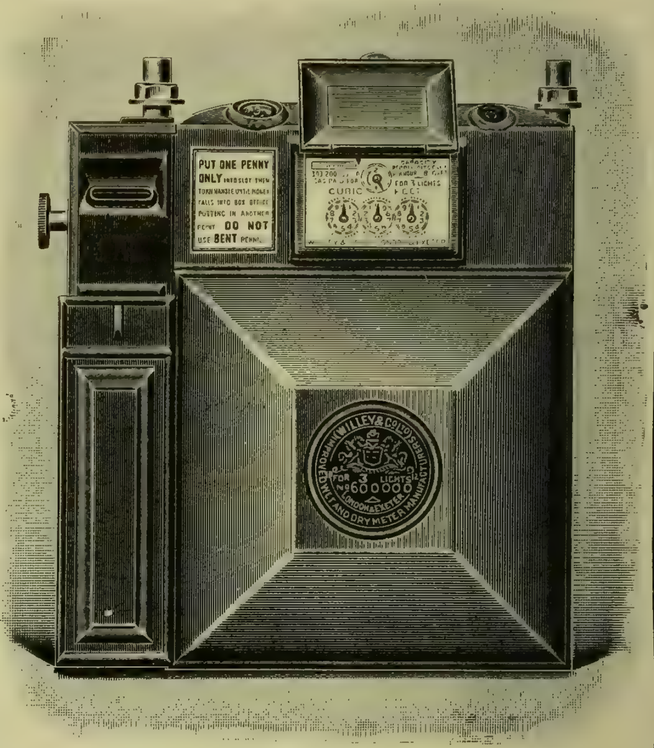
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STOCK MARKET REPORT.

The volume of business on the Stock Exchange last week underwent a considerable contraction, and the tone was somewhat languid and dull; but there was nothing to cause any feeling of anxiety or depression. Market movements are often fitful, and responsive to esoteric influences which are not far-reaching. In Government issues, the War Loan and Consols remained steady until towards the close. Home Rails were rather irregular, although the dividend announcements came fairly up to general expectations. The American Market was very dull; and Canadian Pacifics were dragged down, though the Company is doing fine business. In Foreign, the French loan has been going strong, with a brief interval of profit-snatching. Japanese continued in demand. Argentines revived; but South Africans moved irregularly. In the Miscellaneous group, rubber had a wholesome steadying, but textiles, armaments, copper, and oil were in good request. Among topics of the week, the Chancellor of the Exchequer announced that the 4½ per cent. War Loan scrip and the 5 per cent. Exchequer Bonds will be accepted at face value from subscribers to the next War Loan of long date. At some bank general meetings, the chairmen dwelt on the advisability of fixing a limit to the rate of income-tax on this loan. This would probably attract many foreign subscribers. In response to a Stock Exchange petition numerously signed, the Treasury have removed the minimum prices attached to certain securities. The continued fall in value of the German mark is alarming Berlin circles, and their financial quacks are busy devising nostrums to act as a tonic upon the debilitated exchange. One has heard before now of "Pills against the Earthquake." The question of excluding alien enemy members from the House is becoming more acute, but its legal bearings require consideration. Business in the Gas Market improved both in volume and in tone. On Monday, a bid of 75 for Gas Light ordinary was made; but there was no stock or no seller. Next day, 77½ was given for it. On the removal of the minimum price, Melbourne debenture (the only quoted gas issue which had been "minimized") was promptly done at 91. The Money Market was easier.

Bargains done for cash during the week were as follows: On Monday, Bombay 4⅞, Commercial debentures 55, Imperial Continental 70, 70½, 71¼, 72, Monte Video 8⅜, 8½, South Metropolitan 77, 77½, 77¾, 78, 78⅛. On Tuesday, Gas Light ordinary 74¾, 75¼, 75¾, 77½, ditto preference 76½, Primitiva 2⅛, $2\frac{3}{16}$, South Metropolitan 77¾, 78. On Wednesday, Buenos Ayres 70⅞, 71¼, Brentford debenture, 74, 74½, Gas Light ordinary 75¼, 75¾, ditto preference 75¾, ditto debenture 60½, 61, Imperial Continental 70, 70¾, Primitiva preference £3 10s., South Metropolitan 78, Tottenham "A" 124½, 125. On Thursday, Alliance and Dublin 68, Gas Light ordinary 75¼, 75½, 75⅞, 76, ditto debenture 60½, 61, Imperial Continental 69¾, 70, 70¼, 70½, 70¾, Monte Video 8⅜, Newcastle 81, Primitiva preference £3 11s. 3d., £3 12s., £3 12s. 3d., £3 12s. 6d., South Metropolitan 78. On Friday, British debenture 69, Commercial 4 per cent. 75, 75½, European 12⅞, Gas Light ordinary 75¼, 75⅜, ditto preference 75½, 76¼, Imperial Continental 70½, South Suburban 84½, 85. On Saturday, Gas Light maximum 60, 60½, Melbourne 91, Primitiva preference £3 13s. 9d., South Metropolitan 77½.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	69—64	8 18 2	68
374,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 8	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	4⅞
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water { 10 p.c.	29—30	5 6 8	..
378,480	10	"	7	7/-	B 7 p.c.	15—15½	4 10 4	..
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,240	—	—	—	4	Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 8	..
830,000	"	"	†11	55/-	Do. New	204—209	5 5 8	..
50,000	"	"	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	74—74½
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—218	5 8 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	69
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	70⅞—71¼
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	75—75½
560,000	"	"	5¼	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	55
800,000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 8	..
200,000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk.	102—104	8 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	12⅞
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke { 4 p.c. Ord.	98—102	4 15 6	74¾—77½
2,600,000	"	"	3½	3½	3½ p.c. max.	76—79	4 8 7	60—60½
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10	75½—76½
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	60½—61
130,000	"	"	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	69¾—72
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. { A	211—213	4 18 11	}
718,100	"	"	7		B	146—148	4 14 7	..
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne } 4½ p.c. Deb.	99—101	4 9 1	91
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 18 4	8⅜—8½
1,775,892	Stk.	July 29	4½	4¼	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	81
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	$7/8\frac{2}{5}$	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	6 9 0	..
60,000	50	Feb. 26	18	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	"	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	"	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4	$2\frac{1}{8}$—$2\frac{3}{16}$
499,960	5	June 26	5	2/6	" 5 p.c. Pref.	4¾—5	5 0 0	3/10/0—3/13/9
521,600	100	June 2	4	4	" 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
209,984	"	"	10	10	Do. B	222—224	4 9 8	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	77—78⅛
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	84½—85
60,000	"	"	5	5	Do. 5 p.c. Pref.	110—112	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District { A 5 p.c.	135—138	5 8 8	124½—125
742,275	"	"	6	6	B 3½ p.c.	115—117	5 2 7	..
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 8	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/3	55/1½	" C 3½ p.c.	110—115	5 2 0	..
352,000	"	"	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	"	"	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER AND MANAGER. Sittingbourne Gas Company. Applications by Feb. 12.
CHIEF SALESMAN. Alliance and Dublin Gas Company. Applications by Feb. 7.
CLERK. Redditch Gas-Works.
MAIN AND SERVICE LAYERS. Aberdare Gas-Works.
UNDER WORKS FOREMAN. No. 6147.

Appointments Wanted.

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Meetings.

BRENTFORD GAS COMPANY. St. Ermin's Hotel. Feb. 11. 2.30 o'clock.

Patent Licence.

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BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 8.
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Meters.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 8.

Oxide of Iron (Spent).

KIRKINTILLOCH GAS-WORKS.

Pipes.

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Tar.

ABERTILLERY GAS-WORKS.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

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A. P. GHENT,
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Sittingbourne, Jan. 27, 1916.

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VOL. CXXXIII., No. 2752.] TUESDAY, FEBRUARY 8, 1916. [68TH YEAR.

EDITORIAL NOTES.

The Government Attitude on Freights.

It is a favourite statement of chairmen of gas companies, and we suppose of other enterprises, that, when things are going well, the stock and share holders do not attend the meetings in such numbers as when things are going less satisfactorily, and when dividends decline. Dividends have diminished largely in the case of some gas companies working under the sliding-scale, owing to the war increase in the price of gas. Among such concerns is the Gas Light and Coke Company, whose dividend for the past half year is at the rate per annum of £4 4s., subject to heavy income-tax; while for the corresponding half of 1913, it was £4 17s. 4d., subject to a lighter income-tax. Nevertheless, it may safely be said that the meeting of the proprietors last Friday was one of the smallest numerically that there has been for some time past; and in this fact there is, under the peculiar and harsh circumstances of the times, genuine evidence of confidence in the Governor (Sir Corbet Woodall, D.Sc.) and his co-Directors, which is the best encouragement that the proprietors could possibly confer.

Those who were present at the meeting, and those who read with care the report of the Governor's speech, can only possibly arrive at the one conclusion, that all that has been active in producing disadvantage of a more or less temporary character to the consumers, the proprietors, and the employee co-partners, has been entirely due to outer causes and agencies, and that the Board of Directors and the chief officers have shown, through the results of their financial and managerial policy, considerable grasp and foresight in connection with the unprecedented situation. Many of the external causes which have acted so oppressively, but which are inevitable, the Governor says, the Company could bear with patience and with fortitude. But there are some which appear to him to have been altogether unnecessarily burdensome; and this particularly applies to the rates of freight from the Tyne and Yorkshire. There was a ring of indignation about both the locution and the delivery as he related the facts regarding the attitude of the Government towards this question, and the effects of the attitude. It has again been a case of neglect and want of prescience, and then of seeking for a remedy after substantial and irretrievable mischief has been done; and, in certain high quarters, the seeking is still being carried on in a way that suggests there are feared some hidden terrible consequences to any form of regulating interference.

Everything the Government have so far done has been an incentive to inflated rates of freight. The tale cannot be too often repeated as to how the Government, themselves paying a rate of freight of only 4s. per ton on commandeered colliers, insisted on receiving the extraordinary market rates for interned, unsuitable, and expensively worked steamers, and only to a very slight extent, we gather from Sir Corbet's speech, have they receded from this position. This has borne very heavily upon users of seaborne coal, and upon consumers of gas produced from such coal. While themselves engaged in making excessive profits through the interned vessels, the Government have been preaching against the sin and unpatriotism of manufacturers and traders exploiting the war for the purpose of unduly lining their own pockets. Example is better than precept. The preaching has been lamentably ineffective; and there were last summer merry twinkles in the eyes of certain members of the Government as they said they had well under observation the excess profit makers, and meant to make them disgorge their ill-gotten gain. But here again, when the hint materialized, it was found the means proposed by the Government of putting a brake on the making, owing to war conditions, of super-profits—means relieving the makers of such profits of one-half—merely acted, at any rate in the case of the so-called market rates of freight, as a stimulus to the putting-up of the rates to figures that would leave practically uninjured, after the deduction of the 50 per cent., the fat profits upon which the owners set their minds before the introduction of the Budget last autumn.

"Excess war profits" forsooth! Sir Corbet did not mince matters as to terms. He calls such profits by the more fitting descriptive term of "plunder;" and, in his opinion, a happier and more certain solution of the problem of preventing the making of such "profits" would have been to have taken, in the name of the nation—a nation at war, a nation that should be united as one in doing all humanly feasible to make the weight of it as light as possible—the whole of the excess profits definitely traceable to the existence of war conditions. Those excess profits—so much greater since the Government made claim to a moiety of them—have seriously injured the country and the people, and moreover are having a very deplorable effect upon the peoples of allied countries. They are being sorely irritated, and are becoming doubtful as to the sincerity of our friendship, through the terrible prices they are having to pay—due largely to British rates of freight—for coal and other productions that they require from this country. Other effects of the lethargy of the Government, and their neglect in taking this matter into consideration early in the war, is the fact acknowledged by Mr. Runciman that, while tonnage is short for the country's trade and requirements, nearly 300 ships have, since the outbreak of war, been sold to neutral countries. The Government ought to have prohibited all such sales. Then, further, Sir Corbet stated in his address to the Gas Light proprietors that he understood (though he could not personally vouch for the fact) that there are trading between foreign ports a number of British ships, the owners of which will not bring them back to England lest they should be called upon to contribute to her needs. Contemptuous language cannot be too strong for such men. However, this all goes to show that the treatment by the Government of the question of transport and freights has been muddled from beginning to end.

When cause and effect are considered, when pondered over are past professions on the part of the Government of inability to do anything in connection with this shipping question through the danger of something or other terrible happening, when we read the story told by Sir Corbet, and note his fully justified indignation over both the noxious action and inaction of the Government, a ray of humour falls across it all on reading in a prominent morning newspaper—eighteen months after the beginning of the war, and over twelve months after rates of freight began to show some uneasiness, and then took their upward bound—that "the "Government regard the regulation of shipping freights as "one of the pressing problems of the war." The pressure to-day is largely due to the Government's own past attitude; and this we must not forget. The humour is intensified on reading that they are working at the problem "with vigour, "and hope to obtain a satisfactory solution before long." We all hope they will. Sir Corbet, both at the Gas Light Company's meeting and at the Tottenham Company's meeting on Saturday, remarked upon the fact that the Government have at length appointed a strong Committee to consider the propriety of taking entire control of the mercantile vessels of the country, so that the ships can be used for the urgent service of the country, and at reasonable rates of freight. We hope the Committee will speedily set to work, and will make their power felt in the right quarters and in the right manner; and if their recommendations afford relief from the incubus imposed upon the country by the shipowners, they will have performed a wonderfully good piece of work. A strong Committee is no good, however intrinsically potent their recommendations, unless there is a strong Government Department to receive them, and to successfully urge forward their adoption. Sir Corbet is pleased at the appointment of the Committee; and he has hopes of it. Had it not been for this appointment (he said at the Tottenham meeting), he should have looked at the coming year with consternation. This indicates a confidence in subsequent action by the Government, who have hitherto been so chary over interfering with the shipowners, and who now, if the appointment of the Committee really means action, have got to throw to the winds their past excuses for non-interference.

However, from the general to the particular. The gas industry has a good right to complain of the Government so long turning a blind eye upon extortionate freight charges. The industry knows precisely what it costs to run colliers from the North to London. Last half year the running costs of the Gas Light Company's own ships varied between only 3s. 2d. and 4s. 11d. per ton; the "market" rate of freight was just recently up to 17s. 6d.; some gas coals are to-day being brought from the Tyne to the Thames at 14s. 6d. per ton; and the Government are commanding from 10s. to 14s. per ton for interned vessels. What possible justification—and in war time—could be advanced for the difference between the actual costs of the Gas Light Company's own vessels and the market and Government rates? The gas industry, too, can complain of a want of reciprocity on the part of the Government. One department is day by day pressing gas undertakings for more and more toluol; and, realizing the necessity of increasing the source of its production, it has suggested to gas consumers that they will be rendering help by consuming more gas instead of coal. Another department has for long defended the attitude of non-interference with the so-called market rates for freight, which have largely been the cause of the necessity for putting up the price of gas to figures which nullify the advice and efforts to enlarge the consumption of gas. The departments have been at cross purposes. May we hope that the Committee charged with the duty of inquiring into the question of sea transport will speedily put an end to this state of things in the imperative interests of the country. Anyway, we trust that Sir Corbet's protest will have good, full, and lasting effect.

The Chemist and Fuel Economy.

There is no question that chemists as a body have not been immune from the human failing of having left undone many things that they ought to have done, and of having done many things that they ought not to have done. We are not prepared to make the indictment more specific, except in the one glaring particular that they have not hitherto done anything much outside their own immediate and individual spheres of operation in endeavouring to bring about a general economy of fuel by the adoption of improved processes, and the extraction from coal of the maximum value in products. They have shown, as a body, a passiveness over this matter which, for men in their position, amounts to sheer negligence of a great opportunity; for coal is in a no inconsiderable part at the very base of their professional work, and its proper utilization is the best possible contributor to the broadening of the foundations of their profession and the expansion of their opportunities. In his second Royal Institution lecture [see *ante*, p. 253], Professor W. A. Bone remarked that, as a chemist, he ventured to suggest that what should be aimed at in all schemes of fuel economy is the abolition, wherever possible, of the present truly barbarous custom of burning raw coal, which not only entails the loss of valuable bye-products, but also involves the production of black smoke, with its attendant evils. We submit that chemists ought—it was due to their profession and to their place in the country's work—to have tackled, and to have long ago made themselves felt in relation to, this huge economic problem, and not have left the inauguration of a general movement to this end till the year 1915, when Professor Bone took the matter seriously in hand in his Presidential Address to the Chemical Section of the British Association, and has since followed it up assiduously in a manner that cannot fail to have effect, immediate and ultimate, to the progressive benefit of the country. Fuel departments have been inaugurated at our universities and technical colleges, and men have been, and are being, trained to deal scientifically with fuel problems. This work is having, and will have, lasting economic advantage; but there is an individuality about the beneficial results, and not that general effect which it is hoped to attain (and which will create a greater demand for the trained individual) by a larger and public movement, fostered and aided by the Government as the right courses to pursue unfold themselves.

What is required at the back of a protagonist in a new movement of this kind is an army of willing adherents, ready to assist in stimulating interest both by personal effort and influence among those with or for whom they are working. The greater the aid rendered in this way, the larger the generation of interest, and the more certain is ultimate success. The chemist is engaged on routine duty and research now more or less in almost every industry; where he is not, he ought to be. In those industries in which he is operating, he ought to be a person of influence. At any rate, no one is better personally qualified than the chemist for helping forward this cause of fuel economy, and of the only legitimate uses of coal, which uses are those that do not involve a destruction of valuable products, which are the important raw materials of national industries—the textile, chemical, and agricultural among them. In his second Royal Institution lecture, and in the third one [the latter is published this week], Professor Bone directed attention to industries in which there is scope for large fuel economies. The greatest margin for economy, he said, in the second lecture, is to be found in the coal used at mines for coking (especially in connection with the beehive ovens), in factories, in iron and steel works, and for domestic purposes; and in the third lecture, the use of fuel—solid and gaseous—for the provision of power was dealt with. In the directions cited in the second lecture, a quantity of coal equal to practically four-fifths of the total home consumption is accounted for. The industries mentioned, together with the comprehensive term "factories," cover a large area within which chemists are now actively at work, and should be so to a still larger extent. But the important point is the declaration of Professor Bone—and it is a reflection upon manufacturers and upon chemists as a body for not bestirring themselves earlier in the matter—that, while there may be some industries in which a satisfactory alternative to the use of raw coal may not be immediately forthcoming, in the vast majority of cases serious fuel waste is found for which no really adequate excuse can nowadays be made.

As to the domestic use of coal, there reform must proceed somewhat more slowly, by education, example, and development of the efficiency of heating methods which do not involve waste. Here, again, the chemist should be a person of large influence, and not the passive onlooker at a continuing dissipation, from about 30 million tons of raw coal, of the whole of the ammonia, tar, benzol, naphtha, and other bye-products, representing a value of millions of pounds sterling. This single statement comprises vast opportunities for the chemist; yet he has been—though having a primary interest in the matter—supine and negligent in regard to it. The alternatives to raw fuel for domestic purposes are those that are labour-saving and non-smoke producing—gas, coke, and semi-coke. In his second lecture, Professor Bone bore independent testimony to the efficiency of the modern gas-fire in regard to radiant power and from the hygienic point of view; but he urged the provision of cheaper gas as, with efficient gas-fires, the best propelling force to their adoption. The gas industry recognizes the need; it looks with regretful eyes upon the delimiting conditions of the present, and upon the prospective dearness of coal and increased costs in other directions. But it hopes on; and it looks to the chemist for aid in producing economies which shall in some measure provide compensation to externally imposed obstacles. It is quite true that we have to reckon with the fact that about five times as many heat units can be obtained from coal as from gas—calculating that gas costs as many pence per 1000 cubic feet as coal does shillings per ton. But this fact has not so far been one that has weighed very heavily on the modern progress of gas heating. The more potent influences to adoption have been labour saving and convenience, combined with a good radiant and hygienic efficiency, and that at not (all things considered) relatively much greater cost than coal—particularly for intermittent use, and for continuous use where care is taken to regulate according to temperature requirement. These influences Professor Bone does not mention.

In the quest for fuel economy in the household, Professor Bone looks upon semi-coke as something that will find favour, if the price is right, and if it can stand transport without crumbling up. Apparently, too, he thinks that the war has imparted to low-temperature carbonization processes a larger hope of success than they ever had before, if honestly worked at as a technical proposition on sound lines and with scientific supervision, and without attempts by company promoters at financial booming. It is plain, however, that Professor Bone is not satisfied that these processes have advanced beyond the early stages of technical development. If this is so, there may be a woeful awakening for those who are—is the Ministry of Munitions in any way financially involved?—incurring large financial obligations for the realization of products on the strength of experimentally produced and more or less paper data. Professor Bone is a chemist. The rich light oils of the low-temperature tar are therefore an attraction to him; they contain paraffins, naphthenes, benzenes, and phenols, which from the point of view of motor fuel have interest. But it is certain that, while he looks forward with confidence to this process coming in as an adjunct to the older methods of high-temperature carbonization, he is not satisfied the technical development of the system has yet been carried far enough. There are those who have been engaged in connection with low-temperature processes who will not agree with this estimate of the present position, while concurring without qualification in the anticipation as to the future. There are advice and counsel in the words: "The "question of low-temperature carbonization is so important at this juncture that the Government would do well "to have its prospects investigated and reported upon by a "body of independent and disinterested experts as a precaution against possible set-backs by the foolish or premature "company promotion which so often in this country ruins "the commercial prosperity of a good thing."

All through the piece, the chemist has an inseparable place in this question of fuel economy and the most profitable utilization of coal; and it is for the chemist now to do his part in helping forward a movement which will be beneficial to the nation generally, and not in the least part to his own profession.

Looking Forward.

THERE must always be a looking forward, so far as is possible, with the view of determining what it is necessary to do in the present, in order to be prepared for probable succeeding conditions; and particularly essential is this at the present time in connection with *post*-war probabilities and possibilities. In the gas industry, this applies to everything—from administration to executive work, from capital expenditure to return, from coal purchases to the sales of gas, coke, tar, sulphate of ammonia, or ammoniacal liquor. In no single respect, can we afford to neglect consideration of the conditions that are, subsequent to the war, likely to environ our operations in all these directions, and especially so in the matter of the nature of the competition that will have to be met. It would be folly to assume that, with the cessation of hostilities, we are simply going to return to pre-war conditions. Everything will be totally different; and every industry and every concern will be making most masterly attempts to ensure its profitable ends being as substantial as possible. Whatever our competitors—whether coal merchants, electricity purveyors, manufacturers and dealers in tar products and sulphate of ammonia, or anything else—may do to promote their trading, our business should be, and must be, to endeavour to be prepared to go one better. We know that the coal merchants will use every effort to stem the flow of the popularity of gas for cooking and heating, and to stunt the growth of the applications of coke. The electricity industry has a Development Committee considering matters. Germany, when free to the seas again, will be keener than ever over tar products and sulphate of ammonia, and will carry on their competition seriously. We must look forward.

Much interested, too, will the British gas industry be in what Germany is likely to do after the war in connection with such things as gas-fittings, mantles, glassware, and requisites to the business of gas undertakings, which have been made prolifically in Germany, and in which there has been free traffic in this country. As to glassware, there are rumours as to the likelihood of imports being prohibited for a period after the war, and then subsequently a tariff being imposed. Some colour is given to the rumour by the White Paper issued last week, reproducing the report of a Special Committee of the Board of Trade Advisory Committee as to the measures to be adopted for securing after the war the position of certain branches of British industry. The industries dealt with by the Committee include glassware; and one of the recommendations is that manufacturers who develop industries and produce goods that have hitherto been largely imported should be afforded sufficient tariff protection to enable them to maintain production after the war. Tariff or no tariff, with those gas undertakings that are patriotically inclined, free traffic in German and Austrian goods, we are told, is absolutely ended; and patronage will henceforth, as far as possible, be by them conferred on goods made in this country, and not for the profit of Germany. These are all matters calling for the industry's consideration in respect of prospective conditions. It is well known that—even during the war, while no overseas business is doing—German commercial enterprise extends to the maintenance of agencies and trade emissaries in all parts of the world. It is therefore the duty of this country, and of the gas industry so far as it may be affected, to look seriously to the future, and to counter the enemy by every legitimate means.

In connection with trade generally, through the war we know better than ever before the methods of Germany in building-up a tremendous export trade, and in investing capital in other countries, with the twofold object of localizing, and obtaining some measure of control over, manufacture and trade and thereby profiting Germany, and in reducing the competence of manufacturing countries, through this localizing of manufacture and trade, from competing with Germany's export trade. For example, we know that in regard to certain electrical goods made in this country, German capital was largely employed, and that the export business in these particular goods to other countries has been carried on from Germany. This country has in consequence been the poorer. We are aware, too, how Germany obtained complete control of monazite sands and the supply of thorium nitrate—even of the Travancore sands of India. Since war broke out, there has been greater general interest in the German dye and chemical industries, which have largely derived sustenance from the tar produced by British gas undertakings and coke-oven plants. We know what has been done in these respects; and we must take into account the certainty that the trading acumen and ruses of the past will represent the minimum of what will be done in the future, when Germany comes to grips with other nations in trying to retrieve her lost overseas fortunes and position. Therefore, when in this country we say: "Never again will "we allow Germany to get so far as she has done before in "the work of, by any insidious means, endeavouring to subjugate our industry and commerce," let us hope that one and all mean it, and will patriotically work to this end. The country has made tremendous sacrifices in life and money; and, while life cannot be recalled, much can be done in repairing the other losses by the aid of our resources, fertility of mind, and scientific attainments, if only properly used and applied to the work of expanding our trade by lessening German imports, and doing all possible in increasing our exports at the expense of Germany.

Of course, no one anticipates—no one would be so foolish as to anticipate—that Germany's overseas trade can ever be wholly killed or captured. What can be done is to make as dead-certain as possible that the trade is reduced to the utmost possible limit, and that the economic subjection which Germany was working to place on this and other countries, is definitely made her own portion. The means of doing so have been under discussion in the House of Commons on more than one occasion lately; and the Government and the Board of Trade are taking a lively interest (if not as yet a very fruitful one) in the matter. They recognize that our financial strength can be, and must be, increased through our industry and commerce, and our industry and commerce must be fostered by the Government. But the trouble is that, while all this is recognized, there is an exceedingly modest appreciation of what is requisite; and so a very large vital question is being dealt with in very niggardly and slow-moving ways. Mr. Runciman has made some excellent speeches on the subject, and has given some philosophic advice, and has shown that the Board of Trade have the matter under consideration from many points of view. Preparation for the commercial war that is to come is a matter of considerable magnitude and importance; but the only practical thing that the Government have done so far has been to help forward the national dye scheme. Nothing else has issued from all the investigation, the Committee work, and the torrential flow of talk over future trade. Yet we have seen eighteen months of war; and the time of preparation of practical methods to gain the material ends in view is being lavishly spent. Matters, in short, are proceeding as though the war is going to last for at least a generation. We are told by Mr. Runciman that, if we are to hold our own, we must be adaptable. The country has shown its adaptability in a striking manner in respect of the production of munitions. We are told, too, that there must be improved and greater research in connection with industry, that there must be larger facilities for the training of young men for such work, and that there must be no attempt to economize on the money spent on technical colleges and schools and modern appliances. This is all good. But the views of the Government regarding these matters have been seen in the paltry votes of annual expenditure on research in relation to the dye scheme, and in connection with their Industrial and Scientific Research Committee. It is also urged that there should be an extension of commercial banking in order to help young industries to get on to their feet, that there should be assistance in the development of new inventions, and that there should be a remodelling of the conditions affecting the use of patents. Our transport facilities—sea and land—require to be better mobilized; and labour, too, should be brought into the work of organizing schemes of trade expansion. Last, but not least, coal and oil supplies for the country should be brought under better control.

All this is excellent; but, although in these days we do not expect miracles, if something practically effective is to eventuate, there ought to be present signs of it. There is nothing of the kind; nothing tangible so far; nothing to enlarge our hopes. Will there ever be, unless a body is specially appointed to relieve the Board of Trade and political domination of the work of devising what is necessary to foster industry and trade generally on the best possible lines, and to counsel the Government in regard thereto—a body of a composition which will include representation of industrial, financial, scientific, transport, and labour interests. At the Guildhall meeting last week, the establishment of a Ministry of Commerce was suggested; but the effectiveness of even this would depend upon composition and powers. This preparation for after-war trade is a large matter, and one of vital importance to the economic advancement of the nation. As such, it requires to be dealt with in a liberal manner.

A Joint Committee on Meter Failures.

The last two or three years there has been developed considerable failure on the part of gas-meters to register accurately. This experience is an increasing one; and it is becoming a seriously acute matter. Sir Corbet Woodall referred to it at the meeting of the Tottenham District Light, Heat, and Power Company on Saturday. There must be something unusual to account for this phenomenon, in view of prior satisfactory experience. The meter makers are under the impression that the cause may be traceable to alterations made of recent years in the methods of gas manufacture. However, it is not a matter for haphazard speculation; and so a Joint Committee of the Institution of Gas Engineers and of the gas-meter makers has been appointed to carefully investigate it. Current conditions, of course are against progress being made with the work; but it is proceeding as vigorously as is possible. Sir Corbet said he hoped the inquiry would result in valuable information being forthcoming. That is also the hope of all who are interested.

Sulphate of Ammonia Export Licences.

Since the articles on this subject of a week ago, we learn, on inquiry of the Chairman of the Sulphate of Ammonia Association (Mr. D. Milne Watson), that the position remains unchanged. There is no doubt that the Government have been extremely ill-advised in advertising the fact that exports have been prohibited, as this announcement has made the agricultural community expect that it will be able to obtain supplies at a much lower price. Seeing that the price which sulphate of ammonia manufacturers fixed for home use about the middle of December is 30s. to £2 per ton below the last export prices obtained, there is no reason whatever to reduce home prices any further. Unless farmers make up their minds to buy and take delivery promptly, the Government will unquestionably have to issue further export licences; otherwise many plants will have to close-down. Everything points to there being plenty of sulphate of ammonia in the country to supply farmers' needs; and it is surprising, to say the least, that, in face of this, the Government are refusing to grant any licences for export to France for agricultural purposes, though the much-reduced French production is not equal to the demand. It is certain that hard things will be said about this in France; and it seems almost incredible that the British Government should wish to starve our Allies.

Charges for Restricted Public Lighting.

There has been a fair amount of local discussion here and there, but only in one case litigation, as to what should be the proper charge for contract public lighting under the current restrictions by the military authorities. Important local authorities and important gas companies have found ways and means of amicably settling the matter without being obstinate and unreasonable, and running money to waste by referring the matter to the Law Courts. It has remained for the Leiston District Council, whose existence was previously hardly known by the rest of the world, to go a contrary way. The contract for public lighting included the provision of the lamps, their repair and upkeep, as well as the supply of gas. The District Council contended that, as soon as the military authorities inhibited the lighting, the agreement came to an end. There may be an appeal in the matter if unwise counsels prevail, so that we will not say fully and emphatically what is our estimate of the contention of the Council. Mr. Justice Low did not think much of it; for, in his view, the suspension of the lighting did not at any rate cancel the contract for the provision of columns, lamps, fittings, repair, and upkeep in readiness for a resumption of lighting permanently or on emergency. Nor had his Lordship any power to suspend the contract while the restrictions continue in force.

Mr. Justice Low's Endorsement.

However, there is one ground upon which to thank the District Council; and it is that their action secured an endorsement from his Lordship of what has been the almost universal practice in dealing with contract charges for public gas lighting in view of the restrictions. The Company had offered to give the Council credit for all the gas unconsumed; but the Council preferred litigation to the suggested compromise. His Lordship thought it a pity the Company's offer was not accepted, and suggested that it would be a wise and a fair thing if all local authorities, in similar circumstances, would come to some such arrangement, instead of spending the ratepayers' money in litigation. We hope local authorities will take heed of the judicial opinion, and Parliament of the suggestion that a clause might be inserted in one of the emergency measures for bringing about the adjustment of such a dispute as this Leiston one, which ought never to have found its way into the Law Courts. The fault for this lies with the obstinacy of the Council in not appreciating what in the circumstances was equitable, and what was clearly regarded by the Judge as a selfish attitude.

Gas Manager Claimed to be a "Workman."

The circumstances under which, last September, Mr. E. H. Millard, who had for thirteen years been Manager of the Cowes Gas-Works, met with his death, formed the subject of an application in the Isle of Wight County Court last week, when Mrs. Millard claimed compensation, under the Workmen's Compensation Act. Deceased, who was 54 years of age, went to work on the morning of the day of his death, apparently in good health; and while actively superintending the installation of a new governor in the retort-house, he complained of pain in the chest. Returning to his house, he passed away before the arrival of medical aid; and at the subsequent inquest, the Coroner's Jury returned a verdict to the effect that he died from *angina pectoris*, accelerated by gas poisoning. In the event, at last week's hearing, the legal bearings of the claim were not decided, because before the arguments had proceeded very far a settlement between the parties was arrived at, under which the widow is to receive a small sum by way of compensation, together with an amount for costs. From our report of the case, however, it will be noticed that, on her behalf, it was admitted that there was a difficulty in proving that Mr. Millard was engaged in "manual labour," and that there were also other difficulties in the case, though the contention put forward was that he was actually on manual labour, by reason of strike troubles, shortage of workmen,

&c., which had compelled him even to take off his coat and act as a stoker on night shifts. The point of view taken by the Council's advisers was that Mr. Millard could not be held to be a workman coming within the Act. He received a salary of more than £250 a year, and was engaged under a written agreement by which he was Manager of the works. Whatever may be thought of the legal aspects of the case, all will feel sympathy with the widow and her young family in their trouble.

Showroom Attendants.

In his second article on "A Plea for Showroom Reform" (which appears in this issue), Mr. Cyril G. Davis has a little talk with showroom attendants; and he furnishes them with a range of precept on personal appearance and conduct, attitude towards customers, and mental equipment which, if all put into practice (and we do not see anything that should not be), should make the perfect salesman. Showroom salesmen, of course, are only human; and they, like the rest of us, fall short in perfection, both in respect of qualities and degree. But they also, like the rest of us can do their best to approach as near perfection as possible, and to maintain the standard attained, with constant endeavour to exceed it. Of course, we must start with the man himself. There are some men who could never get out of their ruts, and who have not the brains to enable them to improve. That such men are to be found in some showrooms is due more to those who employ them than to themselves. They would not be there if an adequate salary was offered which would attract men of brains; and men whose daily effort would be to make themselves worthy of their undertaking, of their position, of the recompense for their services, and of from time to time an advance of recompense. Unless showroom attendants have brains (and those having the management of gas undertakings should always make themselves responsible for the selection of men with brains, and so show in the result that they have themselves good judgment), all possible precept, no matter how plain and complete, is not going to do them much good. But given brains and aptitude, observation of the rules which Mr. Davis presents (and which are no doubt already practised by some attendants who have made a full study of their work and position) will produce a salesman such as it is always a pleasure for a customer to meet.

The Precepts.

Some of the hints may appear trifling; but trifles are the things that go to make for perfection. In connection with the personal hints, a soft-headed dandy is not what is wanted; but a presentable, well-dressed, well-mannered man. The man who has the mental equipment laid down in the rules is the man who, though well-dressed and presentable, will not be soft-headed; and he will have balance enough to enable him to keep free of the descriptive term "dandy." We see that Mr. Davis suggests that there is no need to disparage electricity in order to advance the interests and claims of gas. The more winning policy, he says, is: "Electricity is good, but gas is better." We agree. There is no need to disparage; but there is need to follow the advice given subsequently, that the salesman must be armed with accurate figures (memorized if possible) of the comparative costs of heating and cooking by gas and electricity. Without these, and without a knowledge of competitors, the showroom attendant to-day is seriously deficient in equipment. He must have the requisite knowledge to combat the statements of rivals, and, in doing so to "speak the whole truth, and nothing but the truth," of their commodity and applications. The gas showroom attendant may depend upon it that the electricity showroom attendant has poured his tale into the ears of the customer, or, if he has not done so, he will do so as soon as opportunity offers. The customer looking out for fires, cooking appliances, motive power, or industrial heating arrangements, primed with what he has heard at the electricity showroom, will be curious to hear what the gas showroom attendant will have to say on the subject; and the latter must be in a position (in reply to questions) promptly to offer facts which are capable of demonstration. A good showroom, economical and efficient appliances, and an excellent case available for gas, are reduced to futility by an unintelligent, unpresentable, ill-fitting attendant. The attendant must be the mainspring of the showroom, and his efficiency for the position must always be the measure of his own ability, perseverance, and uprightness.

The British Worker and Post-War Trade.

An article, full of thought and sound advice, on the "Problem of the British Worker," appeared in the "Daily Telegraph" last Tuesday. The author is Mr. W. H. Cowan, M.P. He holds very strongly to the view, which seems to be rather too generally overlooked, that the British worker must be an important factor in the coming new and strenuous industrial and commercial war. Therefore the productive capacity and efficiency of the worker must be considered. Physical strength and endurance are points of which sight must not be lost; and to this end reforms are desirable such as the substitution of hygienic for unhygienic surroundings, provision for physical exercises, and inculcation of regular and healthy habits. The improvement of our educational system as it affects the working classes is necessary. In those cases where the British worker suffers from such ills as lack of industry, listlessness, narrow-mindedness, and an imperviousness to new ideas, the fault lies largely with those who have neglected to provide him with the opportunities for acquiring that knowledge which will give him the key to the true significance of the work upon which he is engaged. It is suitable technical education to better fit the men for their work that Mr. Cowan has in mind; and the importance that he lays upon this matter as a factor in enhancing productivity is attested by his words: "Never at any time in the nation's history was the need for a properly co-ordinated system of technical education so sorely needed, and so earnestly to be pleaded for." Another point in enlarging the worker's productivity is a more intelligent co-operation between employer and employed. Again, the policy developed by trade unionism has tended to limit production; trade unionism needs to be re-educated; and its alliance must be obtained in the development of British trade. After-war trade development is as much a question for the British workman as anybody. Germany for years past has been, in her trade expansion schemes, curtailing the sphere and the earning power of British workers, and increasing those of German workers. This being so, all British workers should stiffen their backs, and add to the resistance against the resumption of Germany's not disinterested activities. There cannot be complete stoppage. But unity is strength, and much can be done by a united front.

Attainable Surface Combustion Temperatures.

A point which might mislead, but which was not noticed till after publication, occurred in the paragraph in last week's issue [p. 263] on an American test of a surface combustion furnace. The information given was communicated by the Director of the United States Bureau of Standards to the Franklin Institute. The Bureau is interested in the subject of surface combustion, owing to the ability to realize by it very high temperatures. Tests have been made; but the result of the particular test quoted is stated in a manner which may give an erroneous impression. The test was with a crucible furnace (in another place "muffle" is mentioned) using ordinary gas; and the result is presented thus: "The highest temperature reached was 1675°, at which point the muffle failed." It might be assumed from this that the highest temperature attainable by the surface combustion system is the one mentioned; but, as a matter of fact, we doubt whether even Professor Bone could tell the highest realizable temperature. There is a clear recollection (but the occasion has slipped from memory) that, in one of his surface combustion lectures, Professor Bone pointed out that the temperatures ascertained from experimental work were entirely limited by the heat-resisting capacity of the refractory material used. That the temperature of 1675° is low is evidenced by the records of the Franklin Institute itself, as seen in the succeeding paragraph.

Results of Experiments.

In a pamphlet reproducing the lecture that Professor Bone delivered before the Institute in 1911, there is this note: "Since this lecture was delivered in Philadelphia, a further experiment with the object of determining the maximum temperature obtainable by means of artificial illuminating gas has been tried. An alundum crucible of an extremely high refractory character containing a Seger cone No. 39 was completely melted-down, showing that a temperature approximating 2000° C. had been obtained." There is a substantial difference between the 1675° mentioned in last week's paragraph and the 2000° C. recorded in the quoted note.

Also, at the lecture which Professor Bone delivered before the American Gas Institute at St. Louis on Oct. 19, 1911, he very strikingly demonstrated the high temperatures attainable with surface combustion by melting platinum in a small crucible furnace on the lecture table in view of the whole of the audience, as the following official record, published in the Proceedings of the American Gas Institute [Vol. VI., 1911, Part I., p. 599] completely testifies: "As a final experiment, the lecturer placed a roll of platinum foil in a small crucible of very refractory material, which was then placed in a suitable cylindrical furnace containing a bed of refractory granular material. The mixture of gas and air was then injected, and caused to burn in the bed of granular material, speedily raising it to white heat. After about twenty minutes, the lecturer was able to announce the melting of the platinum. On removing and cooling down the crucible, the bead of platinum, somewhat larger than a full sized grain of wheat, was found at the bottom of the crucible, and exhibited to various persons in the audience. Subsequently, it was presented by the lecturer to the President as a memento of the occasion." Now since platinum melts at 1755° C., it is evident that, in order to melt platinum in twenty minutes from a cold start, Professor Bone must have produced in the experiment in question a higher temperature than 1755° C., which is itself 80° higher than the 1675° attained in the recent test at the United States Bureau of Standards when their muffle failed. We repeat that the temperatures realizable in furnace practice by means of surface combustion are limited by the refractoriness of the materials (crucibles, muffles, &c.) employed in constructing the furnace, and not by the possibilities of the combustion process itself.

PERSONAL.

Mr. A. E. Williams has been appointed to succeed Mr. G. M. Gill at the Stepney works of the Commercial Gas Company.

Mr. E. Fearon, Works Assistant at the Salford Corporation Gas-Works, has been promoted to the position of Superintendent of the Bloom Street Works. He was formerly at Sheffield.

There was gazetted on Jan. 25 (to date back to Nov. 5) the promotion of Major George S. Eunson to the rank of Lieutenant-Colonel in command of the 3rd/4th Northamptons. This reward of 26 years' good service has afforded great satisfaction to both officers and men under his command, as it has also done to those connected with the Northampton Gas Company, of which Colonel Eunson is Engineer and Manager.

The Stockton-on-Tees Corporation last Tuesday presented a framed illuminated address to Mr. William Ford, the late Gas Manager, recording high appreciation of the faithful services discharged by him to the town in this position over a period of almost 47 years. Mr. Ford, in returning thanks, said there was not a member of the present Council who was a member when he received the appointment of Gas Manager. Though he had now retired to the position of a consulting official, he hoped to be of considerable service to the Corporation for years to come.

We join in the hearty congratulations offered by the South Metropolitan Gas Company's "Co-Partnership Journal" to Mr. F. J. Bywater on his promotion to the rank of Major in the Royal Engineers. The Editor (Mr. W. T. Layton) says: "His rise from Second-Lieutenant to Major has been rapid, especially for a regiment in which so much scientific knowledge and administrative ability are necessary to the making of an officer. In these strenuous times, when we can ill spare any of our Engineers, it is consoling to reflect that the Company's loss is the Empire's gain."

Mr. James W. Roper has (subject to confirmation by the Council) been appointed by the Bradford Gas Committee as Manager of the Corporation Gas-Works at Valley Road, in succession to the late Mr. W. J. Dowse. Mr. Roper is one of the younger element in the Bradford gas undertaking, and has been with the department from the commencement of his career, fifteen years ago—the bulk of the time having been spent in laboratory work. He has been Chief Chemist for about six years, and has had practical experience of gas manufacture, having had temporary charge of three of the Bradford works at various times. Mr. Roper is lecturer in "Gas Engineering and Supply" at the Bradford Technical College. For some years past he has been a member of the Yorkshire Junior Gas Association, and has contributed to their "Transactions."

Mr. John E. Dudley, the Resident Manager of the Higginshaw Gas-Works, Oldham, has resigned his position owing to ill-health. He has been employed under the Oldham Corporation for a period of 38 years; the last 16 years being spent as Manager at Higginshaw. Last Wednesday evening, the stokers, &c., presented him with a gold mounted walking stick, umbrella, and pocket wallet, each of which was suitably inscribed. Mr. Tim Duxbury, the Chief Engineer, presided, and expressed, on behalf of himself and the men, their deep regret at losing Mr. Dudley's services, and they sincerely hoped he would soon be restored to his usual health again. Mr. Dudley had been one of the most faithful and conscientious officials of the Corporation, and has always made a special study of his work. Mr. J. Shill, foreman mechanic, in making the presentation, said how sorry they all were that Mr. Dudley had broken down in health, and especially that he had to give up his duties as Manager. Mr. Dudley, in responding, expressed his deep sorrow at being compelled to leave them. He thanked them most sincerely for the beautiful presents, and for their kindness to him at all times. He would always remember the 16 years spent at the Higginshaw Gas-Works.

OBITUARY.

Mr. Olaf Pihl, news of whose death on the 12th ult. has reached this country, was very well known as General Manager and Chief Engineer of the Christiania Municipal Gas-Works; and his decease will be widely mourned, not only in Norway, but also in this country, where he had many friends. Though in indifferent health for some time, his condition was not regarded as serious until two or three days before his death, when cerebral hæmorrhage developed itself. He was born in 1860; and his technical education took place at Christiania and Dresden. For several years he was connected with the Stettiner Chamotte Fabrik; and three years of his working life were spent at the Beckton Gas-Works. After being in charge for some time of the Drammen (Norway) Gas-Works, he formed the Norwegian Gas Company, having works at Christiansand, Arendal, and Aalesund; and after occupying for some years the position of Chief Engineer of this undertaking, he went in 1902 to Christiania, to take up the work which he continued until his death. For some time he had been busy with the question of erecting new gas-works.

Mr. A. C. Scrivener, of Birmingham, whose death last Saturday it is our sad duty to record, will be much missed; for his unfailing affability, his cheerful presence, and his thoughtfulness for others endeared him to all with whom he came in contact. As Agent for the Wigan Coal and Iron Company, Limited, he was best known among gas managers in the Midlands, by whom he was always regarded more as a comrade and as a friend than as the representative of a commercial firm with whom they were doing business. To such an extent, in fact, was this the case, that by such an exclusive body as the Midland Association of Gas Managers he was frequently welcomed as a guest at their excursion meetings—a privilege which was very gratifying to him, and one which was never made use of by him to advance his business interests. Mr. Scrivener, who reached his seventieth anniversary last June, had for a long time suffered from his heart, and been compelled to take things very quietly, though during the last week or so he had not been noticeably worse. He left home for business as usual on Saturday morning, but had only walked the hundred yards across the road to the station, when, as he was quietly entering the railway approach, he had a heart seizure and expired immediately.

A prominent and esteemed member of the French gas industry has passed away in the person of M. Joseph Ancel, for many years head of the Lyons Gas Company, and a Past-President of the Société Technique du Gaz, of which he was one of the founders. M. Ancel was born in Lyons, and always lived in his native town, where he took an active and leading part in the management of a number of commercial undertakings connected with the supply of gas. For forty-five years he was associated with the Lyons Gas Company, and was also a Director of the Compagnie Générale de Navigation and of the Compagnie pour la Fabrication des Compteurs. His presidency of the Société Technique (in 1883) marked the holding of the annual congress at Marseilles, on which occasion M. Ancel delivered an address which was characterized by his confidence in gas lighting in competition with electricity and his forecast of the directions in which the two would prove capable of assimilation under common management. He also rendered valuable help to the Société Technique in its work in connection with fresh applications of gas, the conditions of municipal concessions, and other professional matters. In 1912 he was the recipient of a special token of his contemporaries' regard in the shape of the bronze medal of the Société awarded to "bons ouvriers" of the gas industry; and in 1914 he obtained national recognition by being created a Chevalier of the Legion of Honour.

GAS-STOVES IN AIR-BRUSH WORK.

A recent issue of the "Journal des Usines à Gaz" [Jan. 5] contained a description of the gas appliances used in the manufacture of the steel helmets with which large numbers of the men in the French Army are now being supplied. In the factory of M. Dupeyron, in Paris, an installation of sixty gas blow-pipes is employed in soldering to the interior of the helmet the hooks serving to hold the head-piece and the strap of the helmet. The cost of the gas per helmet is found to be 0·0025 fr., equivalent to 1·40th of a penny.

In another factory, the helmets receive their final finish in the shape of a coating of blue varnish. This is applied not with an ordinary brush but as a fine spray produced by a battery of aërographs or air-brushes, such as are used in many industrial operations, large and small, from the colouring and decoration of Christmas cards to the painting of gasholders and pieces of machinery. In the case of the application of a varnish, means require to be taken for the rapid and cleanly drying of the coated goods; and it is here that gas-heated stoves have demonstrated their great efficiency and economy. In the factory in which the army helmets are finished off to the number of 7000 to 7500 per day, three large gas-stoves have been installed, and have given great satisfaction on the grounds of the regularity and rapidity of drying, the entire freedom from dust, and the reduction of labour, owing to the avoidance of solid fuel and of the heavy work of bringing it into a furnace. The staff is composed entirely of women. Each stove consists of a wrought-iron chamber, 7 ft. in height and breadth and 3 ft. 6 in. in depth. A series of seven shelves accommodates 168 helmets. Each stove is heated in the lower part by eight rows of burners consuming from 3½ to 4 cubic metres (120 to 140 cubic feet) of gas per hour and raising the temperature of the chamber to 130° C. (300° Fahr.), at which drying is complete in about an hour. The cost of drying works out to 0·005 fr. (1-20th of a penny) per helmet.

THE "SCOTTISH GAS INDUSTRY" AMBULANCE CAR.

We reproduce a photograph of the motor ambulance car presented by the North British Association of Gas Managers to the Red Cross Society—Scottish Branch—as mentioned in "Notes from Scotland" to-day. The car has a "G.M.C." chassis, four-cylinder, 15 h.p. It was made by Mr. William Park, of Crawford Street, Glasgow.

The Gasman at the War.

Glancing from time to time over the contents of the magazines which several of the larger gas undertakings now publish for the benefit of their own employees, one can hardly fail to be struck by the high mark of excellence which is reached in many of the letters printed from those members who have joined the Colours and are either at the front or in training here. The writers see and do so many things which are of interest to their fellows who are not in khaki; and they appear not only to be good judges of what they should say, but to be able to say it well. This is a faculty to which we are pleased to see a writer in the "Manchester Guardian" recently paid generous tribute. He remarks that Germans who before the war flattered themselves that they had calculated to a nicety the whole of England's military resources, failed to notice the most significant figures they met. For instance, they forgot to send any report home "about the young, well-made man who, as they passed, was on his way to collect the pennies from an automatic gas-meter—a genuine gasman, not a Le Queux mystery in disguise, and yet emphatically one of the men who were to wreck the most elaborate Prussian schemes." He then goes on to make the point which has already been referred to—that "the romance of the war is to be found in the letters these men (civilians plunged into a soldier's life) send home; and, fortunately for future generations, many of the records are preserved in the monthly journals of those firms which send large numbers to the front." Special allusion is made to the "Co-Partners' Magazine" of the Gas Light and Coke Company; but the remarks would equally well apply to other publications of a similar character. The letters so well written are frequently tales of thrilling adventures—such as a gasman in times of peace would hardly dream of. In the case of the Gas Light and Coke Company, the first D.C.M. was won by a man from the Goswell Road Branch, who in happier times had been wont to keep high-pressure lamps in order. He is now a mechanic on a submarine. And only last week we recorded the case of a gas-fitter, trained at Hertford, who after a few days' service with the Basingstoke Gas Company was called to the Colours, and has had bestowed upon him the Victoria Cross. The industry is proud of its fighters.

COMMERCIAL GAS COMPANY.

Half-Yearly Report.

The following is the report for the six months ended the 31st of December, which the Directors of the Commercial Gas Company will present at the half-yearly meeting on the 17th inst.

The Directors submit the accounts for the half year ended Dec. 31, 1915. The revenue account shows a net profit for the half year of £72,760 6s. 10d., which, added to the balance of £65,623 19s. 1d. brought forward from the previous half year, produces a net revenue balance of £138,384 5s. 11d. Deducting £8838 15s. 8d. for interest, there remains standing to the credit of the net revenue account a balance of £129,545 10s. 3d. available for dividend. The Directors recommend the payment of the statutory dividends thereout at the rate of £4 18s. 8d. per cent. per annum upon the 4 per cent. stock of the Company, and of £4 13s. 4d. per cent. per annum upon the 3½ per cent. stock, both less income-tax. The balance of the net revenue will be carried forward to the next half year. Messrs. H. D. Ellis and H. W. Gell, two of the Directors, retire by rotation, and, being eligible, offer themselves for re-election.

William Graham Bradshaw, Chairman.

Gas-Works, Stepney, Feb. 1, 1916.

The Accounts.

The accounts accompanying the report consist of the usual set of statements. They show that the paid-up stock on the 31st of December amounted to £996,405; that £1,076,875 had been added by conversion, making £2,073,280; and that £149,298 remained unissued out of the total authorized capital (including premiums) of £2,235,000. The total amount borrowed on the above-named date was £339,062 10s., and £135,937 10s. was added by conversion; making a total of £475,000, and leaving £79,226 to be borrowed out of the £550,000 authorized. Capital account receipts amount, with premiums, to £2,606,065 4s. 5d. The expenditure stands at £1,463,116 2s. 1d., with a nominal amount of £1,212,812 10s. added by conversion—together, £2,675,928 12s. 1d. There is thus a balance of £69,863 7s. 8d. carried to the balance-sheet. A sum of £4990 was expended during the half year on new and additional mains, services, stoves, &c., and £1380 on additional freehold land. The reserve fund amounted at the close of the half year to £40,859, and the insurance fund to £31,954.

The following is the revenue account:—

Receipts.

Sale of gas—		
Per meter (number in use, 115,860) at 2s. 8d. per 1000 cubic feet	£220,463 4 5	
Public lighting and under contracts	4,825 16 5	
	£225,289 0 10	
Less discounts and allowances	7,609 17 10	
		£217,679 3 0
Rental—		
Meters (24,566)	£2,951 3 11	
Stoves (82,930)	13,160 2 10	
Prepayment meters and fittings (90,631)	17,930 11 10	
Maintenance of mantles and fittings	737 1 10	
		34,779 0 5
Residual products—		
Coke, less £3586 1s. 10d. or labour	£45,275 2 11	
Breeze, less £882 7s. 5d. for labour	1,256 9 9	
Tar	10,337 4 9	
Ammoniacal liquor and sulphate of ammonia	13,307 4 3	
		70,176 1 8
Miscellaneous receipts—		
Rent receivable	£0 10 0	
Transfer fees	23 15 0	
		24 5 0
Total receipts		£322,658 10 1

Expenditure.

Manufacture of gas—		
Coal and oil, including dues, carriage, unloading, and trimming	£121,668 3 4	
Salaries of Engineer and officers at works	3,111 0 7	
Wages (carbonizing)	11,610 6 6	
Purification, including labour	1,015 6 0	
Repair and maintenance of works and plant, materials and labour (less £72 16s. received for old materials)	30,717 7 10	
		£168,122 4 3
Profit sharing		2,385 10 7
Distribution of gas—		
Salaries and wages of officers (including rental clerks)	£5,960 5 3	
Repair, maintenance, and renewal of mains and services, material and labour	8,978 17 1	
Repair and renewal of meters	3,019 4 5	
,, ,, ,, ,, stoves	11,648 8 4	
,, ,, ,, ,, prepayment meters and fittings	11,299 14 6	
Maintenance of mantles and fittings	1,290 11 7	
		42,197 1 2
Public lamps—lighting and repairing		2,754 19 3
Rent, rates, and taxes		16,398 12 4
Management—		
Directors' allowance	£1,250 0 0	
Company's Auditors	75 0 0	
Salaries of Secretary, Accountant, and clerks	1,002 0 5	
Collectors' salaries and commission	1,448 12 4	
Prepayment meter collection	4,089 17 4	
Stationery and printing	1,221 18 0	
General charges	2,820 12 0	
		11,908 0 1
Bad debts		373 12 7
Law and parliamentary charges		105 3 4
Superannuations and allowances and Workmen's Benefit Society, &c.		2,531 5 1
Official officers, &c.		168 19 2
National Health and Unemployment Insurance		492 7 11
Allowances to employees on active service		2,460 7 6
Total expenditure		£249,898 3 3
Balance carried to net revenue account		72,760 6 10
		£322,658 10 1

The following statements relate to the working:—

Statement of Coal and Oil.

—	In Store June 30, 1915.	Received During Half Year.	Carbonized During Half Year.	Used and Sold During Half Year.	In Store Dec. 31, 1915.
	Tons.	Tons.	Tons.	Tons.	Tons.
Coal	25,173	97,466	92,755	705	29,179
Oil—gallons . .	352,435	1,429,635	1,307,683	..	474,387

Statement of Residual Products.

Description.	In Store June 30, 1915.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store Dec. 31, 1915.
Coke—tons	2,191	57,972	6,224	47,882	6,056
Breeze—tons.	4,112	6,511	..	5,873	4,750
Tar—gallons	417,078	1,221,823	..	1,086,942	551,959
Ammoniacal liquor—butts of 108 gallons	6,077	31,148	28,992	..	8,233
Sulphate of ammonia—tons	130	949	..	954	125

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Quantity Accounted for.	Number of Public Lights.
	Public Lights and under Contracts (estimated).	Private Lights, per Meter.		
Thousands.	Thousands.	Thousands.	Thousands.	
1,882,495	23,066	1,654,317	1,705,619	3820

The last statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, oil, &c., £36,311; coke and breeze, £5947; tar, ammoniacal liquor, sulphate of ammonia, &c., £10,873; sundry stores, £41,031—total, £94,161. The figures this time last year were: Coal, oil, &c., £23,403; coke and breeze, £3128; tar, ammoniacal liquor, sulphate of ammonia, &c., £10,725; sundry stores, £36,606—total, £73,862.

ELECTRICITY SUPPLY MEMORANDA.

Municipal electricity supply finance is always an interesting topic—sometimes even fascinating. The "Electrician" is fascinated by it just now, and is setting itself up as an expert adviser on the subject. A business, under any circumstances, should not, we gather from the argument, be run as a whole; but there should be division. Whatever the prevailing conditions, each division should be made to pay for itself; and no division should be called upon to bear losses incurred by any other division. Our contemporary lets itself "go," and refers to the "rottenness" of the finances of certain municipally-owned electric generating stations. The expression is an emphatic one; and, although we are averse to the use of strong language, the term quite accords with our own views. But what worries our contemporary just now is that municipal electricity committees continue to propose and to inflict increases of price on the ordinary electricity consumers; and this is considered very wrong, though to be honest municipal electricity undertakings should pay their own way, the same as any other business concern. Brighton is the illustration. On several occasions, the Corporation have made appropriations from the electricity profits in aid of the rates. Not all electricity concerns are in the happy position of having profits from which appropriations can be made; and many are the electricity undertakings that have had to draw upon the pockets of the ratepayers for maintenance. We do not like profit appropriation for aiding the rates; and we do not agree that it is honest to rob the general body of ratepayers for supporting a municipal trading concern. We cannot without research say positively whether the Brighton electricity undertaking has ever indulged in plundering the ratepayers, in order to supply its own financial deficiencies. Whether or not it has done so, two blacks do not make a white. If it is "rotten" to so appropriate profits, it is "rotten" to make people pay for losses which they have had no part in producing. The position with electricity is not the same as with a universal water supply.

"Rottenness."

The Private Consumer and Public Lighting.

But the point of the argument is this. The "Electrician" states that considerable expenditure has been incurred in providing plant for lighting the streets by electricity. This plant our contemporary apparently does not regard as an integrant of the undertaking. But it would have it treated as a separate fraction, and, while having practically no street lighting, it would make the ratepayers generally (though generally they have not desired the plant) answerable for all the usual expenses associated with it. The ratepayers would not, by this monitor as to the correct principles of business finance and management, be treated as the customers of an ordinary trading concern; but it would tax them for something that they have not had. The argument is a strange one. The plant, it is stated, is of no use till such time as street lighting can again be indulged in on an "extravagant" scale. The admission as to extravagance will not please those responsible for the Brighton Electricity Department. However, it is held that "the attempt to saddle consumers with any part whatsoever of the losses brought about by the absence of street lighting is unjust." Next we shall have our contemporary arguing, contrary to electrical practice, that it is unjust to saddle private lighting consumers with any part of the capital, depreciation, and managerial charges associated with the provision of plant and energy for power purposes, which plant in some stations has outrun that needed for lighting purposes. It was Mr. Horace Bowden, of Poplar, who was saying the other day that not a few electricity undertakings cannot make both ends meet during the summer months, and so have to rely for compensation upon the income received from heavy priced lighting units during the winter months. The only rational way of treating a business enterprise is as a whole, and not as though it was made up of water-tight compartments. But in so treating it, there should be fairness to each class of consumer, though no person should be charged for what he does not have. Gas companies do not charge the local authorities anything for the gas manufacturing plant that is less fully employed owing to the absence of a large part of the public lighting. No charge is made for gas unconsumed; all that the local authorities are asked to pay are the expenses connected with the maintenance of the lamp columns, lanterns, and burners in a condition for use as soon as required. Gas companies, however, have no power to ask that the ratepayers should be taxed for the losses due to the lower consumption of gas and to the idle or less fully-used manufacturing plant.

A Simple Plan and a Slight Correction.

A few words more about Brighton, principles, and other things. Our contemporary says: "The endeavour to adopt a rebate tariff, beginning with 5½d. per unit, is an impudent one; for at a time like the present there is no reason why big hotels, places of entertainment, and large shops should not bear their fair share of the cost of the undertaking. This fair share per unit is found by dividing the whole of the fixed charges (less street-lighting charges) by the number of units sold." But what about load, diversity, and other factors that it is asserted are taken into account, but actually are not always nowadays, in order to arrive at a mathematically correct charge? If the simple unadulterated plan advocated by the "Electrician" for ascertaining the amount of the fixed charges to be borne per unit in times of war is correct, then it would be right for peace times, and for all purposes—always. In another place our contemporary refers to our statements, in a previous reference to Brighton, and the question of public lighting charges [*ante*, p. 192], that the Gas Company are also suffering from reduced public lighting, that private enterprise has to fight its own battles, and that municipal enterprise is nursed at the expense of the general ratepayers' pockets. Our contemporary remarks that these statements need some slight correction, and adds: "May we remind our contemporary (though in the main correct) that private enterprise does not run the risk of the confiscation of its profits for the relief of rates as do so many municipal undertakings." There is a lot of confiscation of the profits of gas undertakings going on by local governing bodies. It is often found that, while gas undertakings are assessed for rating purposes to the tip-top level, municipal electricity undertakings are not. It is often found, too, that where municipal electricity undertakings exist, gas undertakings are not allowed to make any profit from public institutions, but all the business is transferred to the electricity concerns. Further confiscation of profits takes place by relieving the gas undertakings of the whole, or the main part of the public lighting, and passing it over to the municipal electricity department, without any consideration for the large outlay involved in making the change, or whether the streets are more efficiently and economically illuminated. Profit appropriation in aid of the rates does not by any means end the comparison. Electricity undertakings have not suffered to the extent that municipal gas undertakings have done from this very vicious policy. Look at Manchester. The aggregate amount of gas profits that have been transferred to aid the rates would have more than repaid the whole of the outstanding capital of the undertaking. Just think of this—a capital-freed gas undertaking at Manchester. Forsooth, the Electricity Department of the city to-day would have had a bad time in the competition, if there had been no gas profit appropriation. Therefore, we have no doubt Mr. Pearce, the Electrical Engineer, while strongly objecting to the principle of profit appropriation, has good cause to privately bless the fact that it has been so lavishly exercised in relation to the gas undertaking.

Variability of Cost.

Not long since, reference was made in the "Memoranda" to the paper read by Mr. Wilkinson, before the Scottish Section of the Institution of Electrical Engineers, on the use of thermostats in connection with the electrical heating of rooms, in order to economize, which is extremely necessary with such a low thermal value agent as electricity. The "Electrical Review," in their last issue in January, published a report of the discussion which took place on the paper. Some interesting statements were then contributed by Mr. W. W. Lackie, which pointed to two things: First, that the outlay for electricity in one house cannot be taken as any criterion of what the cost will be in another house of the same dimensions; and, second, that, in using thermostats for controlling the temperature of rooms, great care must be taken as to the position in which they are located. In the first place, he stated that in November, 1914, the Glasgow Corporation rented premises for the administration of the Prince of Wales' Relief Fund; and the Electricity Department were given the work of heating. The principal apartment was 60 ft. by 36 ft. by 12 ft. high; the total capacity being about 25,000 cubic feet. By arranging radiators alongside individual desks, he states, that ample heating was provided by an installation taking a total of 10 KW. The premises were occupied for practically a year; and the consumption of energy was 17,000 units, which at ¾d. per unit, gave a bill of about £55, or £5 10s. per KW. installed. And quite enough too. The radiators were not in use for 365 days; and Mr. Lackie omits to mention how many hours they were actually running during the year. Then he referred to the electrically equipped bungalows in a Glasgow suburb. The size of these varies from only 7000 to 12,000 cubic feet, and each house has from 10 to 12 KW. of electric heating appliances, including water heaters. The largest consumption of any one of these houses was for the year ending May, 1915, 14,000 units; the bill being £40. This only works out to an average of 0·685d. per unit. In other cases, he states, the annual consumption was only half of this. Speaking broadly, however, the consumption of electrical energy in a house, he finds, may be ten to fifty times what it would be if current was only taken for lighting. Further, in Glasgow there are 10,000 domestic consumers; and 2500 of these have heating appliances of some kind—the total consumption for lighting being 500,000 units, and for other purposes twice this amount. Again, a "large number" of street lavatories in Glasgow have water-heaters installed, taking from 3 to 10 KW. each. The annual bill for these varies from £7 to £30 per annum depending on the work to be done, about which no information is reported. There are no complaints as to the cost; and no "serious" trouble with the apparatus. It may be assumed that the lavatories are under the control of the Corporation; if so, we are not surprised there are no complaints regarding cost. As to trouble with the apparatus, "serious" is a term which has different significance with different people, and according to their interests.

Ventilation, and Thermostatic Control of Heating.

Mr. Lackie went on to relate certain experiences, as given to him by Mr. Goslin the Electrical Engineer to the Glasgow Corporation Tramways, with regard to electric heating at the head office of the department. Mr. Goslin finds that the question of electric heating is bound up with that of ventilation. Where the heating is adequate without provision of ventilation, complaints are soon heard of dry throats, and other forms of discomfort and irritation. We are not surprised. This points to an excess of convected heat, and the drying of the atmosphere. Mr. Goslin believes in thermostatic control for the purpose of saving current. Without thermostatic control, he says, a room may become heated to (say) 74° Fahr.; whereas with automatic control it may be maintained at (say) between 59° and 60°. But apart from the interest, not to say usefulness, of the information as to ventilation in association with electric heating, the results of an experiment in a room as to the placing of thermostats for the purpose of controlling the temperature are instructive. In the room, Mr. Goslin placed 36 thermostats, at different heights and in different positions. He found that there was as much as 10° difference of temperature between a place near the ceiling and one near the floor-level; also that there was a difference of 5° between the temperature near a window and that of an adjacent wall. This points to the fact that the thermostat must be very carefully placed in a room, or the temperature in the living part may not be that required. Mr. Goslin also established the very practical fact that one watt-hour raised 100 cubic feet of air 1° Fahr. He recommends large low-temperature heaters and automatic air-regulators.

Southern District Association of Gas Engineers.—The March Meeting of the Association will, the Hon. Secretary (Mr. H. C. Head, of Winchester) states, be held at the Hotel Cecil at 2.30 on the 16th prox. Afternoon tea will be served; but the Committee have decided that, owing to the war, it is not desirable to have the annual dinner.

"Transactions" of the Société Technique.—The volume of proceedings of the Société Technique du Gaz en France, for 1914 (prepared under such disadvantageous circumstances) has been received. It contains a report of the proceedings at the forty-first annual congress, which took place in Paris on June 18 and 19, under the presidency of M. Auguste Boutan, Managing-Director of the Lyons Gas Company. The compilation under present circumstances of a book consisting of nearly 900 pages, and with 25 plates, reflects great credit upon the officials of the Society—particularly the Secretaries (Messrs. Rolland d'Estape and G. Gautier). Extracts from most of the papers reproduced in the volume were published in the "JOURNAL" immediately following the meeting.

IN THE INTERESTS OF GAS—A PLEA FOR SHOWROOM REFORM.

By Cyril G. Davis.

[Second Article.]

HOW ATTENDANTS MAY CO-OPERATE.

In one of the many encouraging letters evoked by my former article ["JOURNAL," Nov. 2, 1915], appeared a suggestion that I should utilize the present opportunity to "draw attention to the enormous use the showroom can be in educating the whole of the employees of a gas undertaking;" and this excellent point adds another and potent argument to those which I have endeavoured to formulate in favour of securing a high standard of showroom maintenance.

My present purpose, however, is to try and enlist the co-operation of showroom attendants in the worthy cause of showroom reform; and to suggest that, by doing all they can to promote the interests of gas and the undertaking they serve, they will most assuredly enhance their individual reputations and material prospects.

Self-Help for Showroom Attendants.

There is no reason why any gas showroom attendant with "his heart in his work" should not find in his daily environment both the inspiration and the opportunity essential to a successful career. Indeed, progress may well be rapid for one able to absorb all that showroom experience may be able to teach; for good work in the gas showroom may well prove to be a stepping-stone to a higher position. It is to assist eager aspirants to realize such a legitimate ambition that the accompanying hints, touching on personality, demeanour, mental equipment, and the psychology of selling, are now tendered.

Personal.

Cultivate smartness in appearance. This involves a wholesome regard for personal cleanliness—for well-cared-for teeth, trimmed nails, and hair tidiness. Observation tends to show that these hints are not in all cases superfluous.

Be careful not to allow your finger ends to become cigarette stained. If you *do* smoke cigarettes, use a holder.

Dress as well as your means will allow, rather better than worse. By observing what it is that pleases you in the dress of others, you may best judge what is becoming to yourself. Quietness, dignity, and good taste, invariably characterize the toilet of the well-dressed man.

A clean shirt and collar, well-polished boots, a neatly arranged tie, a front-and-back crease in your trousers, the daily use of a clothes-brush—these may be details; but they are important, in that they all make for smartness in appearance and collectively sustain one's business *morale*.

Do not change into an old coat when you get to business in the morning. To do so shows a disrespect for your job, and in any case is false economy.

By creating the impression that you are a highly-paid man, you will enhance the importance of your own opinions and statements, and (who knows?) may even show an intelligent anticipation of Fortune's intention towards you.

Be proud of your showroom, and make your showroom something to be proud of. That is to say, elevate the prestige of your job, and do not be trammelled by its supposed limitations. In this connection gas managers will find it to their own advantage to afford showroom attendants as much scope for initiative as they individually deserve.

A Few Aids to Selling.

Have an eye to the attractions of your showroom. Periodical re-arrangement imbues even a permanent display with novelty and freshness.

See that everything in your showroom is kept in apple-pie order. One blemish may suffice to hide any amount of perfection.

Never leave the showroom unattended. You know the impression you get when you go into a shop yourself and find no one there to serve you.

Do not loiter at the showroom entrance when "business is quiet." Many a would-be customer has been kept out of a shop by the salesman's own obstruction of the doorway.

If you cannot get to the door in time to open it for a visitor, at least be there to accord a respectful welcome. A bright and cheery reception tends to put the caller in a buying mood. Never allow the visitor to open the door when leaving.

Have plenty to say to visitors. Gas is an interesting business, and enthusiasm is highly infectious.

Avoid the stereotyped "What can I do for you to-day, Madam?" "Madam" has been asked that so often. "What may I have the pleasure of showing you?" is a courteous and more appropriate introduction.

Let the visitor be made to feel that you are taking a keen personal interest in his or her requirements. The average response will be worth all the effort.

When the inquiry is for a gas-fire, show an intelligent appreciation of the visitor's requirements by asking the size of the room to be heated, the windows in it, and whether it is a reception room, bedroom, or nursery. Large fires should be recommended for bed-rooms and dining-rooms, which require to be comfortably heated in as short a time as possible. If the object of the call is a gas-cooker, it is equally important to know for what number the stove is intended to cook.

Do not tire your visitor, and do not get impatient yourself. It should be your aim to put him or her under as much obligation as possible by the trouble you go to, and to create the impression that the employees of the undertaking you serve are *eager* to assist customers in their difficulties. Visitors to a gas showroom are sometimes very trying; but patience and tact in your attention to them will bring its reward, though perhaps only indirectly.

Indifferent showroom attendants sometimes allow their patience to become exhausted, and in a spirit of pique leave the visitor to saunter around the showroom unattended. This attitude is distinctly wrong, and the very antithesis of good salesmanship.

Do not let it be necessary for the lady to "talk it over with her husband." This usually means that she has not been satisfied with what she has been shown and told.

"Pressure to buy" in the ordinary sense is played out. Rather put the case for gas in such a way that the visitor is made to feel that there is something to lose by not doing business.

Remember that a consumer who has come about a cooker is also a possible hirer or purchaser of a gas-fire, geyser, circulator, radiator, or other gas-using apparatus. You may not "get in" all these at one time, but you can sow good seed.

If you do not effect a sale (the cleverest salesman cannot do business in every case), see that the visitor takes away something, be it only a pamphlet—*plus*, of course, a good impression—as a gas reminding souvenir.

It should not be difficult for you to elicit the name and address of your visitor. This done, follow up an abortive call with a timely letter, so worded as to create the impression that you have been "worrying about it." If one letter does not suffice, try another later.

Be courteous and obliging, even to the humblest visitor; and do not forget that the unassuming lady you are about to greet may prove to be closely acquainted with some influential person. This does not imply obsequiousness, which to the average person is as repellent as rudeness.

Try and overcome whatever diffidence you may feel concerning yourself and your abilities. The gas showroom is no place for the bashful man.

Study human nature. You will encounter all "sorts and conditions" in the gas showroom, and ready ability to understand a visitor is a wonderful help to successful salesmanship.

Be cheerful and optimistic in your interviews. The "doleful demeanour" is fatal to business.

Put all the earnestness and vim into your work that you possibly can. Healthy vitality is always impressive.

Sympathize with complaints, and humour the aggrieved. It may be a consumer's "own fault;" but it is never tactful to emphasize this aspect of the case.

Be always willing to call on a consumer—in your "own time" if need be—to advise on any gas matter. It may be extra work; but it is also extra experience.

There is no need to disparage electricity in your efforts to advance the claims of gas. A more winning policy is: "Electricity is good; but gas is better." Gas has plenty in its favour to warrant this good-natured tolerance.

Aim at progressive returns. Last year's figures should be this year's minimum.

Be honest in all your statements and transactions. Honesty is the basis of confidence; and confidence begets business.

MENTAL EQUIPMENT.

n the gasshowroom, as elsewhere, knowledge is power. Learn your stock; why it is there; what it will do; what space each item will occupy in domestic position; how much gas it consumes; and so on. And be instantly ready with the hire rates, cash prices, and hire-purchase terms, as the case may be. It is only inefficiency that has to "go and inquire."

Such information as you find it impossible to keep at your finger's ends have carefully entered in a properly indexed waistcoat pocket-book, ready for immediate reference.

Arm yourself with accurate figures (memorized, if possible) of the comparative costs of heating or cooking by electricity and gas. These (which can be had for the asking from the Information Bureau of the British Commercial Gas Association, 47, Victoria Street, London, S.W.) are convincingly in favour of gas.

Cultivate mental agility with figures. The ready calculation of a percentage has effected many a sale.

Use quiet intervals—if opportunity permit—for studying gas text-books. There is a handy manual entitled "Competition Points for Gas Salesmen," which every showroom attendant should read and study.

While not foregoing judicious recreation, utilize your spare time, also, in developing your mentality. Preparation of this kind will increase your self-respect, and must sooner or later react on your prospects.

Read the trade papers regularly, and thus keep abreast of gas developments. Something may even be learnt from the advertisement pages.

Lastly, instead of relying on a timid application for a "rise," rather make your claims to preferment so obvious that they cannot be overlooked without injustice.

TO SUM UP.

The characteristics which the aspiring showroom attendant will find it to his enduring interest to cultivate may be stated as follows:

Smartness in appearance; respect for his job; unfailing courtesy, patience, and tact; sound business judgment; conversational skill; mental alertness; cheery optimism; transparent honesty; justifiable self-confidence; intuitive appreciation of others' foibles; enthusiasm for gas; mastery of gas facts; tenacity of purpose; eager desire for self-improvement; and, not least, the imaginative faculty.

This may strike the reader as a somewhat formidable schedule, yet the qualities essential to success in this, as in almost any walk of life, are so closely co-related that one might crystallize them all in a single comprehensive requirement—viz., *unflagging interest in one's daily work.* Given this, in nine cases out of ten, all else proceeds.

And with this healthy spirit animating the staffs of the many gas showrooms up and down the country, who will say that gas and all associated with the advancement of the industry would not be held in higher public esteem?

CONSOLIDATED GAS COMPANY BUILDING.

SOME time ago there were given in the "JOURNAL" illustrated particulars of the new eighteen-storey building, approximately 300 feet long, which has been provided by the Consolidated Gas Company of New York, to meet the pressing requirements of the Company and all the allied gas and electric undertakings. The building has been designed on extremely generous lines in every respect. That we had already known. But it has been still further impressed upon us by the receipt of a descriptive book, of which it may be said that it is worthy of the building with which it deals. The photographs—and there are about fifty of them—are of the best; while the letterpress is brief, and to the point. In the general get-up of the book, good taste, as well as good workmanship, shows itself. A gas company with evidence of this kind at its hand needs no more to maintain the justness of its claim to be regarded as enterprising. It was proof of enterprise to erect the building, and it is further proof of enterprise to publish so luxurious an account of it.

With an eighteen-storey building 300 feet long, there is, of course, a good deal of space—both inside and outside. While convenience and comfort have been everywhere studied in respect to the interior, the claims of the exterior have by no means been overlooked. The rear and easterly walls are carried up with a light and dark shade of buff brick, forming panels, thus relieving the flat effect which is so often noticeable in tall buildings. The architectural features have been designed, too, with a view to night illumination; the ornamentation of the stone work and the iron grille in the upper storeys containing receptacles for numerous lights. The steel structure was designed by the Company's engineers; the total weight of the steel used in the framework of the building being 6600 tons. All the connections were drilled and riveted; and the work was so accurately dimensioned that even in placing the 60-ton girders at the top of the building, drifting and reaming were unnecessary. The main entrance is all in marble and bronze; and customers having business to transact pass through handsomely appointed display rooms on their way to the clerical department. There are display rooms for different types of apparatus; considerable space in the basement being devoted to fuel appliances.

The large volume of gas used in the building for power, light, and heat requires a separate room for the meters; and hot water is supplied from a battery of automatic gas water-heaters. In connection with a large restaurant for the employees, there is a complete gas kitchen equipped with the most modern appliances for the demonstration of domestic and hotel cooking; and there is also a smaller kitchen where all the cooking is done by electricity. Excellent provision is made for lectures and meetings; and the "minor" conveniences include a barbers' shop for the benefit of the employees. The building is piped for gas throughout; and a large advertising sign is placed on the roof. When illuminated by the 4000 lamps placed in the 15-feet letters, this sign can be read for many miles. Truly, they do things on a big scale in America.

It was mentioned in the opening of this article that some illustrated particulars of the building had already appeared in our pages. These will be found in the issue of the "JOURNAL" for Feb. 17, 1914 [p. 426].

The February issue of "A Thousand-and-One Uses for Gas" has on the front page an illustration showing the part gas plays in shell-making from start to finish. It is an industrial fuel number, and contains a special article by a Furnace Expert based on the paper recently read by Mr. B. W. Brooks before the London and Southern District Junior Gas Association.

THE UTILIZATION OF ENERGY FROM COAL.

By Professor WILLIAM A. BONE, D.Sc., Ph.D., F.R.S.

At the Royal Institution last Thursday, Dr. WILLIAM A. BONE, F.R.S., Professor of Chemical Technology at the Imperial College of Science and Technology, delivered the third, and final, of a series of lectures on the above subject. The two previous lectures appeared in the "JOURNAL" for Jan. 25 and Feb. 1, pp. 206-208 and 253-256 respectively.

Of all directions in which we may look for the achievement of further great economies in coal consumption, probably none are more promising than those of power production on a large scale, and in the iron and steel industries. Therefore, I purpose to deal more particularly with these two aspects of the fuel question in this, my concluding, lecture. Inasmuch as I cannot do more than touch upon these subjects in a general way, and want to avoid as far as possible the use of technical terms and expressions, so as to bring the broad facts of the situation home to the lay mind, I must ask my professional *confrères* to view with leniency any departures that I may make from the orthodox way of presenting such a subject to an audience of technical men.

POSSIBLE ECONOMIES IN POWER PRODUCTION.

The total available energy in coal varies according to its character and its ash content; and it is usually expressed in terms of heat units per unit weight of the dry fuel. Here I would like to suggest that coal, which is intended to be used for power and heating purposes, should be sold in this country, as it is in America, on a calorific basis. The introduction of such a reform is not only reasonable, but it would also bring the sales of fuel for large-scale power and heating purposes more under supervision and control, and would accustom the user of coal not only to demand a certain calorific standard in the fuel he is buying, but also to ascertain what portion of the total available energy he is utilizing.

We shall not be far wrong in assuming for our present purposes that the heat equivalent of the available energy in 1 lb. of a good average coal is 13,000 B.Th.U. Inasmuch as the heat equivalent of a horse-power-hour is 2564 B.Th.U., it follows that, were we able by any means to transform the available energy in coal into mechanical power without loss of any kind, we should obtain a horse-power-hour output of work by the expenditure of about 0·2 (one-fifth) lb. of coal.

Now, according to Mr. Beilby's estimate, 52,000,000 tons of coal were consumed for power purposes in the United Kingdom during the year 1903, and the average consumption per horse-power-hour was no less than about 5 lbs. This means that we were then only converting on an average about 4 per cent. of the available energy of the coal burnt into useful work; the other 96 per cent. being wasted.

There are two principal ways in which we may convert the energy of coal into mechanical work. One is by raising steam in a boiler and then utilizing as much as possible of the energy of the steam in some form of steam-engine, either of the reciprocating or turbine type; the other is by gasifying the coal completely in some form of gas-producer, where the incandescent fuel is converted into a mixture of CO_2, CO, H_2, CH_4, and N_2, under the action of a steam and air blast, and then burning the resulting gas in an internal combustion engine. Both these methods are imperfect, of course; but it may perhaps be of interest if we compare them from the point of view of thermal efficiency.

In the first place, the thermal efficiency of a good modern type of coal-fired boiler is not far short of that of the gasification of coal in a gas-producer, where allowance is made for the fact that it is necessary to clean and cool the resultant gas before it is delivered to the engine. We shall not be far wrong in putting down the efficiency of each method under good working conditions at about 75 per cent. Now, under favourable working conditions, a gas-engine will convert about 27 per cent. of the energy of the gas supplied into available horse power; so that the coal consumption required to obtain a shaft-horse-power-hour by means of the combination of an efficient gas-producer and a gas-engine need not be more than 1 lb.

$$\frac{0{\cdot}20}{0{\cdot}75 \times 0{\cdot}29} = 1 \text{ lb.}$$

In the year 1903, to which Mr. Beilby's estimate applied, the best gas systems in operation did not require, when working at full load for twelve hours a day for six days a week, a consumption of coal at the producer of more than about 1 lb. per brake-horse-power. Hence it would appear that about four-fifths of the 52,000,000 tons of coal burnt that year for power purposes might possibly have been saved had the most efficient gas systems been universally employed and worked at nearly full load under the most favourable conditions. At that time the efficiency of the best type of reciprocating engine was not more than about 15 per cent.; so that the combination of a steam-boiler and engine did not then convert more than from 11·25 per cent. of the available energy of the coal into shaft-horse-power. Therefore the coal consumption of the best "reciprocating" steam system would be about $2\frac{1}{2}$ lbs. per brake-horse-power-hour.

$$\frac{0{\cdot}20}{0{\cdot}75 \times 0{\cdot}1125} = 2{\cdot}37 \text{ lbs.}$$

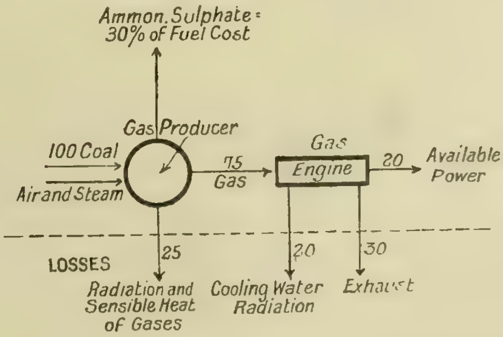
From this it is evident that about one-half the coal consumed for power purposes in the year 1903 might have been saved by the universal adoption of the best steam systems.

Since 1903, however, great advance have been made in the development of the steam-turbine; and, according to the published results of trials on the new 35,000 H.P. Parsons turbo-alternator erected at the Fisk Street Power station in Chicago, the fuel consumption on so large a turbine steam set (assuming a boiler efficiency of 75 per cent.) has now been reduced to 1 lb. of coal per horse-power-hour;* so that there is now probably little to choose between the thermal efficiencies of the best types of steam and gas systems, each working under the most favourable conditions. Inasmuch as each system can now, under its respective best working conditions, generate power with a coal consumption of not more than 1 lb. per horse-power-hour, it is evident that, if everything approaching the truly appalling average consumption of 5 lbs. per horse-power-hour estimated by Mr. Beilby for the year 1903 (or even half this figure) holds good today, there is still room for enormous economies. No doubt the position has improved on the whole since the year 1903; and until definite data are available for 1913 it is difficult to say what is the possible margin of fuel economy in power production to-day. But it is probably not less than 20,000,000 tons per annum, and may be considerably more.

Broadly speaking, the solution of the power problem involves several separate considerations. First of all, of course, there is the question of the relative thermal efficiencies of the different systems of converting the energy of coal into available power. But this is by no means the only, or in the majority of cases the most important, consideration. Equally, and sometimes more, important is the further question of the general planning and organization of a power scheme in regard to capital outlay, running costs, and other conditions of a local character. The question of the ultimate net cost of the power, including cost of fuel, labour, supervision, interest, redemption, and depreciation, must always be the main and over-ruling consideration in any given case; and it by no means follows that the most efficient system from a purely thermal point of view will, under any given conditions, be necessarily the cheapest in the long run.

Bearing this in mind, I may now point out certain considerations relative to the rival claims of gas and steam systems in respect of the fuel problem at the present moment. Some years ago, it appeared as if the combination of the gas-producer and internal combustion engine would soon out-distance the boiler and steam-engine, partly because of the then much superior thermal efficiency of the internal combustion engine, and partly also because of the capacity of the gas-producer to gasify low-grade coal under ammonia-recovery conditions—two very important considerations. It must be remembered that a great deal of coal obtained by the miner is so inferior in quality that it does not usually pay to bring it up to the surface, and it is therefore left below in the mine; and it is claimed—quite rightly I think—that the gas-producer is more capable than any form of boiler of dealing with such inferior grades of fuel, and, moreover, can gasify it under ammonia recovery-conditions. On the other hand, the capital outlay and the ground area involved in the erection of an ammonia-recovery gas-producer plant, as compared with a boiler installation, have hitherto formed formidable obstacles to the extension of the system. Attempts are being made, which I trust will prove successful, to overcome this disadvantage; and a type of ammonia-recovery plant is now offered to the public which claims to have succeeded. If the result of independent investigation and a sufficiently long experience of its working confirm this claim, an important step forward will have been achieved.

The following diagram shows approximately the net efficiency (coal to brake-horse-power) of a gas-producer internal combustion engine combination. Calling the coal energy to be debited against the system 100, the items to be credited to it under full working conditions are 20 in respect of brake-horse-power, and an amount of ammonium sulphate the net profit on which may be put as equivalent to about 30 per cent. of the cost of the coal gasified. Of the energy losses involved per 100 coal energy, 25 are in respect of radiation and sensible heat of the hot gas at the producer, and approximately 50 at the gas-engine—20 in respect



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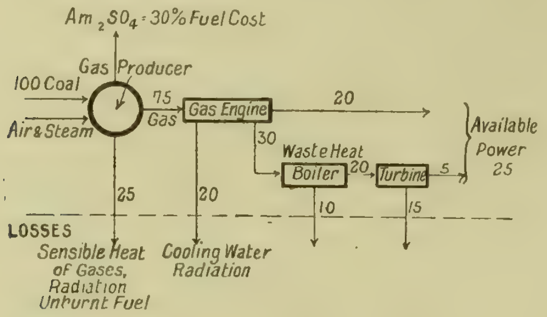
* During the trial in question, working with steam at 200 lbs. gauge pressure and 200° Fahr. superheat, with a vacuum of 29 inches, a shaft-horse-power-hour was developed for a steam consumption equivalent to 9600 B.Th.U., which, assuming a boiler efficiency of 75 per cent., would be equivalent to a boiler consumption of 1 lb. of coal of a net calorific value of 12,800 B.Th.U. per lb.

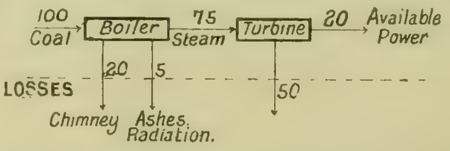
of loss in cooling water and radiation, and 30 in respect of the exhaust gases.

Now, it is possible to improve this result by coupling the engine exhaust to some form of waste-heat boiler. In connection with my investigations upon surface combustion in relation to steam raising, we evolved a type of multitubular waste-heat boiler in which the exhaust gases from an internal combustion engine are passed through tubes packed with granular material, the effect of which is to bring about a very rapid heat transmission between the hot gases and the water in the boiler, so that a considerable proportion of the energy in the exhaust gas is quickly transferred to the water and is obtained in the form of steam. Assuming it to be possible in this way to reduce the temperature of the engine exhaust (say) from 600° to 200° C., and to generate steam at 60 lbs. pressure for a turbine, the total brake-horse-power efficiency of the system might be increased from 20 to about 25 per cent., as shown in the next diagram.

Turning, now, to the results obtainable from the combination of coal-fired boiler *plus* turbine, which are shown diagrammatically in the next slide, it is seen that against the debit of 100 in respect of coal energy the only credit is 20 in respect of available power, assuming 27 per cent. as the turbine efficiency. There is no possible credit in respect of ammonium sulphate, and, moreover, the boiler must be supplied with a good grade of fuel.

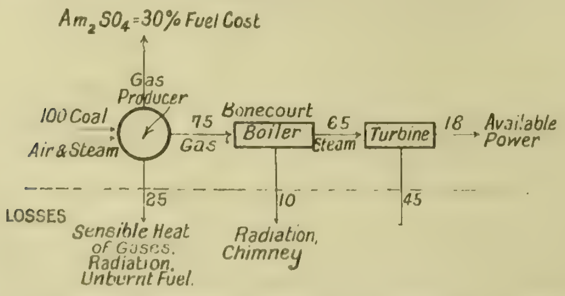


One of the principal losses in connection with steam raising from coal is due to the low efficiencies and evaporative powers of the best types of coal-fired boilers, and, moreover, until recently gas-fired boilers have been so inefficient that their use on a large scale was out of the question, except where great surpluses of gas were available which would otherwise be wasted. The invention of the method of burning gases flamelessly in contact with incandescent surfaces, however, upon which I had the honour of lecturing here two years ago, has provided a means of achieving both very high efficiencies and evaporative powers with gas-fired multitubular boilers on a large scale. The following table shows the comparative heat balances obtained in actual trials of (1) a large "surface combustion" multitubular boiler fired by coke-oven gas of net calorific value 510 B.Th.U. per cubic foot at N.T.P., and (2) a marine boiler fired with good steam coal of net calorific value 13,800 B.Th.U. per pound (volatile matter 16·1 per cent.).



—		Gas-Fired Surface Combustion Engines.		Coal-Fired Main Boiler.	
Heat utilized		92·7		75·1	
Heat lost	in burnt gases	3·0	7·3	18·1	24·9
	in unburnt gases, &c.	*nil*		2·8	
	by radiation	4·3		4·0	
		100		100	

With the possibility, now within reach, of achieving such high thermal efficiencies in gas-fired boilers, I venture to suggest an alternative scheme, which would combine the advantages of the gas-producer (with its capacity of dealing with low-grade fuel under ammonia recovery conditions), with the high efficiency of the modern steam-turbine, as shown in the next diagram. The raw coal would, in the first instance, be gasified in a producer under ammonia-recovery conditions; the resulting gas would then be burnt in a surface combustion boiler the efficiency of which with producer gas may be put down at certainly not less than 85 per cent. Finally, steam could be turned into a steam-turbine, of assumed 27 per cent. efficiency, yielding a net result of 17·3 per cent. in respect of power on the available energy of the coal consumed, *plus* 80 lbs. on ammonium sulphate per ton of coal.



So much, then, for the efficiencies of coal to power energy conversion obtainable, either now or in the near future, with the most modern and scientific apparatus and methods. With regard to the rival merits and prospects of the steam-turbine and internal combustion engine, which time and experience alone can finally decide: (1) That from the point of view of the size of units, the turbine has shot far ahead of its rival (the large Parsons turbo-alternator recently installed at Chicago is 35,000 H.P. capacity, far surpassing anything yet attempted with an internal combustion engine unit); (2) that, whereas a gas-engine only works at its highest efficiency with a high load factor, a turbine maintains its efficiency over a wider range of load than its rival, and at low load far surpasses it; (3) that a gas-engine requires much more lubrication, but, on the other hand, usually less cooling water, than the turbine; and (4) that, owing to its simpler construction, the turbine requires less adjustment and repairs, and is more reliable than its rival.

These considerations have led to the almost universal adoption of the steam-turbine for large power stations, except in cases where there are available supplies of surplus gases from coke-ovens, blast-furnaces, or the like. On the other hand, for comparatively small units—say, up to 2000 H.P.—where the load factor is uniformly high and not subject to abrupt variations, the gas-engine has certain advantages. In any case, however, the choice between the two rival systems will not usually be determined on purely thermal considerations, but on other equally important factors.

It is clear, however, that if we are to achieve all the economies in respect of power production which modern engineering has made possible, two things must be brought about by some means or other. Firstly, the owners of existing inefficient plants must, supposing their requirements be large enough to justify their using a separate generating plant, be prepared to put them on the scrap heap without remorse, and, if necessary, the State might advance a portion of the money required to substitute a really efficient plant, on reasonable conditions as to interest and repayment. It is surely not business to continue the use of inefficient plants, where the possible economies to be effected by the substitution of more efficient ones can be shown to be sufficient to yield a good and sure return on the additional capital required; and there can be no better investment of public funds than in the aid of schemes productive of large economies yielding an immediate and assured return in the outlay involved. If the State is prepared to handle the matter in a broad businesslike way, it would be justified in insisting upon large individual users putting their inefficient power-houses in order. Secondly, in order to meet the necessities of the innumerable class of relatively small consumers, the whole question of the organization of public power schemes for the generation and distribution of electrical energy in the most efficient manner, and at the lowest possible cost, should be taken up.

Hitherto, local jealousies as well as vested interests, which our lawyer-ridden Parliament has fostered far too much, have blocked, and are still blocking, the way. How often in the past, in connection with water, gas, and electric light schemes, has Parliament encouraged the formation of small rather than of large and more efficient undertakings—a policy which has proved as disadvantageous to the community at large as it has been profitable to the lawyers who frequent the Parliamentary Bar. A typical example of this sort of thing is afforded by the public electricity supply for Greater London (area = 693 square miles, population = 7¼ millions), in which there are, or were recently, no less than 65 separate authorities supplying electricity, upon 49 different systems, from 70 generating stations containing 585 engines, and distributed at 24 different voltages to the consumer, who is charged at one or other of over 70 different rates and prices!

The average size of the generating stations is only 5285 K.W., and of the generating units only 632 K.W. Many of the older stations contain reciprocating engines, and some have even to cart their coal—a truly ridiculous state of affairs. But, notwithstanding these disadvantages, London's demand for current per head of the population has increased five-fold since 1900, and is still expanding. There is probably no area in the world which, in regard to density of population, easy access by sea to abundant fuel, and possibilities in the way of rapidly expanding demands for electricity, both for power and lighting, is more admirably adapted for the development of a public supply of cheap electricity under a single authority, with consequent great economy of fuel and in the cost of production generally. How long will the people of London allow these natural advantages to be nullified by the short-sighted policy which has prevailed hitherto?

NORTH-EAST COAST POWER SCHEME.

Given suitable conditions, there are great advantages to be gained in the way of cheap power production by the co-operation of consumers with a properly-organized electric power company operating over a large industrial area; and probably no other European country is so well adapted as our own for such co-operative schemes, because of the compactness of our great industrial areas, the densities of their population, and their proximity to the coalfields. In every industrial area there are factories normally working during the day only; others must of necessity work both day and night without ceasing. In some cases, the power requirements are fairly uniform throughout the day's run; while in others the requirements are subject to large and abrupt variations.

Some establishments—for instance, steel rolling mills—have intermittent loads for short periods far in excess of their average hourly requirements; others, again—for instance, bye-product coke-ovens or blast-furnaces—have large surpluses of gas which cannot be fully utilized on the plant itself. Other factories, also, may have surplus energy to dispose of in the form of so-called "waste heat" or of unutilized "exhaust steam." In every large industrial area there are enormous energy losses continuously going on in different ways, which the individual manufacturer is either unable to utilize effectually himself or about which he is indifferent.

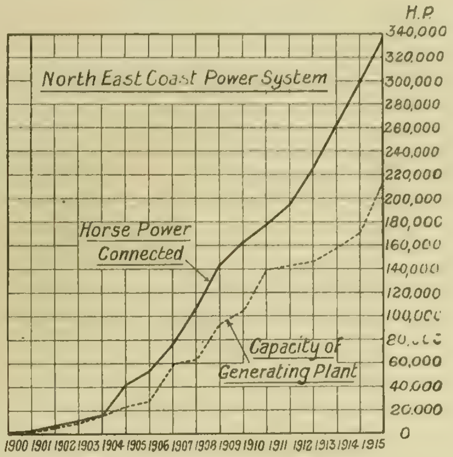
Suppose that the manufacturers in such an area, instead of maintaining a large number of independent, and probably inefficient, power stations of comparatively small sizes, were to co-operate in a well-organized electrical power scheme, whereby all the separate factories, with their variable demands, are linked-up with a few large and efficient power stations, suitably situated in regard to coal supplies, and equipped with the latest generating machinery in considerable units. And, suppose, further, that the organizing company are prepared not only to sell electrical energy, but also to purchase surplus gas, waste heat, and exhaust steam from any of its customers, and convert the same into electrical energy, it is fairly obvious that, in such circumstances, greater economies could be achieved by reasonable co-operation than would be possible under any purely individualistic scheme.

A splendid example of what may be achieved in this way is afforded by the North-East Coast power scheme, which has been so wonderfully developed during the past fifteen years throughout the area covered by the great Northern coal and iron fields, which extend from Morpeth and Blyth in the North to the Cleveland District in the South; and it may perhaps interest you to hear something of its history. The area in question is a remarkable one in many respects. With a population of about 2½ millions (or, say, 5 per cent. of that of the whole country) it produced in 1908 no less than 20 per cent. of the total coal, 36·4 per cent. of the total coke, and 37·5 per cent. of the total iron, raised or made in the kingdom. Owing to its three deep estuaries of the Tyne, the Wear, and the Tees, it built in that year no less than 36·5 per cent. of our total output of shipping tonnage.

It is the district which gave birth to the first public railway in 1825, and in which, two years later (1827), John Walker, of Stockton-on-Tees, invented the first lucifer match. Later on, after the discovery of the Cleveland ironstone beds, it led the world in the development of that mighty engine of production, the modern blast-furnace for iron smelting, and brought to fruition the basic steel process. It was there that Joseph Swan invented the incandescent electric lamp, and that Sir Charles Parsons has developed the steam-turbine. It has built and armed many of our biggest and swiftest battleships and cruisers; and in the "Mauretania" it produced the world's fastest liner, which broke all Atlantic records, and hopelessly outclassed the best that the Germans could build. In its recently developed power scheme, it has achieved the most original and extensive development, on a commercial scale, of electric power for industrial purposes. The result has been a great saving of coal and a reduction of smoke throughout the district, due in part to the concentration of power production and the abolition of inefficient generating plants, and in part also to the utilization of surplus gases, waste heat, and steam, which were formerly wasted.

The present scheme owed its inception to an amalgamation or association of three power companies—namely, the Newcastle Company, which started in 1889 as a small lighting company; the Durham Company, which started in 1901 with three generating stations at Jarrow, Gateshead, and Durham; and the Cleveland Company, which started in 1903, with its principal generating station at Grangetown, near Middlesbrough. In addition to these three Companies, the scheme has absorbed the Durham Collieries Electric Power Company and the Northern Counties Electrical Supply Company. There are now seventeen generating stations—namely, five coal-fired (total capacity, 11,600 H.P.), six waste-heat stations (total capacity, 18,600 H.P.), one partly coal-fired and partly gas-fired (capacity, 45,000 H.P.), two partly coal-fired and partly waste heat (total capacity, 18,500 H.P.), and three partly waste heat and partly gas-fired (total capacity, 17,600 H.P.). The total capacity of the generating plant installed up to the end of last year was 211,800 H.P. The gases utilized are either coke-oven gas or blast-furnace gas, of which there are enormous surpluses in the area. The waste heat stations utilize either the sensible heat in the burnt gases from coke-ovens or the exhaust steam from blowing engines in ironworks, which, before being delivered to the steam-engine, is sometimes "superheated" by the combustion of blast-furnace gas. All the prime movers are steam-turbines; no gas-engine being used. When gas is employed as a source of energy, it is always burnt under boilers, generating steam for turbines.

The next diagram illustrates the phenomenal development of the scheme during the fifteen years (1900-1915) since its inception. The total horse power connected is now nearly 340,000; while the total capacity of the generating plant is nearly 220,000 H.P. The system supplies electricity in bulk to towns and urban districts at prices considerably less than it would cost any local authority to generate it. The North Eastern Railway Company have electrified some forty miles of the Newcastle suburban railways, and, in addition, drive by electricity from the Power Company's mains their locomotive works at Gateshead, their waggon shops at Shildon (790 H.P.), the repair shops at Walker Gate, Tyne Dock, and Percy Main, as well as the goods stations at Newcastle, and their docks at Middlesbrough (800 H.P.) and Hartlepool (540 H.P.). The Railway Company also are very large customers for current for lighting purposes. Many tramway companies in the area are also large customers. Most of the large industrial establishments—including collieries, ironstone mines, iron and steel works, shipbuilding yards, engineering shops, cement works, soap and alkali works, flour mills, and electro chemical factories—are connected with the system. In short, the scheme is not only a triumph of engineering skill, commercial enterprise, and scientific organization, which probably cannot be matched in any other area in the world, but also is a standing proof that the British manufacturer, who is so often derided by learned professors in London who know him not, is still capable of leading the world in the matter of power organization.



PUBLIC SUPPLIES OF GAS FOR INDUSTRIAL PURPOSES.

Having given such prominence to the question of public supplies of cheap electrical energy generated from coal, I must not overlook the important subject of the organization of cheap supplies of gas for manufacturing purposes, which is playing a great part in the promotion of more scientific means of applying and controlling industrial operations. The larger users of gaseous fuel will doubtless continue to find it cheaper and better to generate producer gas by the complete gasification of coal and coke on their own premises than to purchase gas from any public company. But there remain a very large number of industrial consumers whose individual needs for gas are not large enough to warrant the installation of separate gasification plant, but whose requirements constitute, in the aggregate, a very large and important demand, which can only be met economically by a public supply company.

Some of the large towns gas-works, situated in industrial areas, are taking up the matter with great energy and success. Thus the Birmingham Corporation has installed a splendid system of high-pressure gas distribution throughout its industrial area, and before the war was supplying manufacturers with coal gas at a pressure of 12 lbs. per square inch, at a net price varying between 11·4d. and 15·2d. per 1000 cubic feet. During the year ending March 31, 1913, no less than 1,900,000,000 cubic feet of gas (or 22½ per cent. of the city's total output) were sold in the Birmingham area for industrial purposes. It is largely used for aluminium and brass and lead melting in crucible furnaces, for the hardening, tempering, and annealing of metals, for the annealing of glass, and the like.

The Sheffield United Gas Company have been no less enterprising. In 1913, the smallest consumer in Sheffield paid no more than 15d. per 1000 cubic feet for his gas, and consumers using more than 500,000 cubic feet per annum were charged 12d. per 1000 cubic feet for all gas between the first 500,000 cubic feet and 6,000,000 cubic feet per annum, and only 10d. per 1000 cubic feet for anything in excess of the last-named quantity. This enlightened policy has led to a considerable use of coal gas in some of the Sheffield steel-works, chiefly for the hardening, tempering, and annealing of special steels (including tool steels), and for file forging—all of them operations in which accurate temperature control is a matter of vital importance. One works alone was using 18,000,000 cubic feet per annum in connection with the manufacture of agricultural implements. In this connection, I must mention the enterprise of the South Staffordshire Mond Gas Company, who, from the central generating station at Dudley Port, near Tipton (South Staffordshire), were recently distributing Mond gas of a net calorific value of 140 B.Th.U. per cubic foot at N.T.P. in mains over an industrial area of 123 square miles, and selling it to consumers at 1¾d. per 1000 cubic feet, which is equivalent to town gas at 7d. per 1000 cubic feet—a figure that promises well for the future of such schemes in areas of similar industrial concentration.

FUEL ECONOMY IN THE IRON AND STEEL INDUSTRIES.

The history of research and invention in relation to fuel economy in the iron and steel industries since James Neilson, the Manager of the Glasgow Gas-Works, introduced in 1829 his revolutionary idea of using hot blast in the smelting of iron, is veritably a romance to be handed down to posterity as perhaps the finest record of British creative achievement in the domain of applied science during the Nineteenth Century. Unfortunately, the few minutes that remain will not allow of my giving you more than a glimpse of its concluding chapter, which relates more particularly to the utilization of blast-furnace and coke-oven gases in the manufacture of steel. Although it is a chapter to which British, Belgian, and German chemists and engineers have equally contributed during the past twenty years, I should like to mention especially the name of the late Adolphe Greiner, the distinguished head of the Cockerill Works at Seraing, near Liège, to whose enterprise the world principally owes the development of the large gas-engine for dealing with blast-furnace gas, and whose recent death, after a year's bitter experience of German invasion, all British metallurgists deplore.

The British iron and steel industry still labours under the disadvantage compared with its German rival on account of its much earlier development. We built most of our blast-furnaces and rolling mills during the iron age, when it mattered little whether or not the smelting of iron was carried out on the same site as the subsequent manufacture of rails and plates. The modern German industry, on the other hand, took its rise after the invention of the basic steel process, when the great advantages of close proximity of blast-furnaces, steel works, and rolling mills were so manifest that all subsequent installations of plant were expressly planned and laid out so far as to secure them. Consequently, whereas all the great German works erected during the past thirty years have, from the outset, embodied and profited by these advantages, many of the older British plants have had to be gradually remodelled, as circumstances permitted, so as to conform, as far as possible, to the new conditions. Such a process necessarily takes time, and there are still some of our works that have not yet completed the change.

In times past, therefore, when the furnace plant was isolated from the coke-ovens on the one hand, and from the steel-works and rolling mills on the other, coke was manufactured at the pit head in the old beehive ovens and then railed to the blast-furnaces. The pig iron made in the blast-furnaces was then sent (often cold) to the steel-works, where it was converted into steel, and the latter subsequently rolled into girders, plates, rails, &c.—operations necessitating an additional expenditure of fuel. For this purpose raw coal was gasified in producers at the steel-works, and a further quantity of it was also burned under boilers to provide steam power for the rolling mills. For every ton of iron produced at the blast-furnace, 1·6 tons of raw coal had to be coked at the colliery, and an additional 0·75 ton at least had to be sent to the steel-works and rolling mills, entailing in all an expenditure of not less (and often more) than 2·35 tons of raw coal per ton of finished steel sections produced.

Now, the natural laws and conditions governing the reduction of the iron ore in blast-furnaces, which were formerly not so well understood as now, are such as to make it impossible to utilize in the furnace itself more than about one-third of the energy of the coke charged into it *plus* the energy of the hot blast. The remaining two-thirds leaves the furnace partly as heat in the molten iron and slag, but mainly as combustible gas.

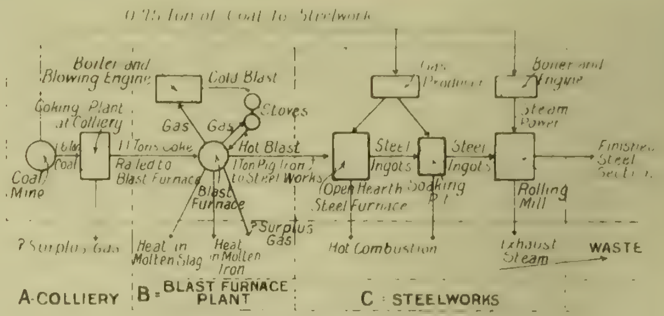
Heat-Balance of a Blast-Furnace.

Heat of combustion of coke .	= 90	Heat utilized in furnace . .	= 30
Sensible heat of blast . .	= 10	Heat of combustion of gas .	= 45
		Heat in molten slag and iron	= 15
		Radiation or other losses .	= 10
	100		100

Thus, for every ton of iron produced, some 168,000 cubic feet of gas, containing from 28 to 30 per cent. of carbon monoxide and about 1 per cent. of hydrogen, leave the furnace, the potential energy of which is about 45 per cent. of that of the coke charged into the furnace.

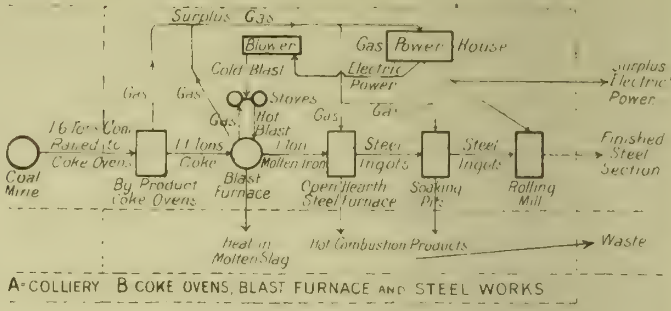
About 60 per cent. of this gas could be utilized for generating and heating the blast; but the balance of 40 per cent. was a surplus for which no further use could be found, unless the plant either adjoined, and was worked in conjunction with, the steel-works, which was not always or often the case, or (as was only possible within recent years) some independent power company was at hand to purchase it. Hence the blast-furnace manager had no particular interest in the gas beyond the portion of it which could be utilized on his plant, and it mattered little to him how much was lost by leakages, or how inefficiently it was burnt under his boilers; for he always had more than enough of it.

The rapid development during the past fifteen years of the large gas-engine in relation to blast-furnace gas, which we owe chiefly to the pioneering labours of Belgian engineers during the years 1896 to 1900, and later also to German enterprise, has entirely changed the whole complexion of the case, and inaugurated a new era in fuel economy of which we, in this country at any rate, are only beginning to reap the benefit. It has been my privilege during recent years to see these new possibilities demonstrated in the Skinningrove Iron and Steel Works, which have been remodelled and extended under the direction of my relative Mr. T. C. Hutchinson, who has brought to bear upon the task a life's experience in the pursuit of fuel economy in this branch of industry. Without troubling you with unnecessary technical details, I will now indicate the nature and significance of these reforms, which are on the point of being realized.



Total Coal Consumed, 2·35 tons.

Production of Finished Steel on Old Plan.



Total Coal Consumed, 1·6 tons.

Production of Finished Steel on New Plan.

The cardinal feature of this new development is the concentration of bye-product coke-ovens, blast-furnaces, steel-works, and rolling mills in one plant, coupled with the utilization of the combined surpluses of coke-oven gas and cleaned blast-furnace gas, partly in large gas-engines driving dynamos generating electrical energy for driving the rolling mills and all other machinery on the plant, and partly also to displace producer gas as the fuel for the steel-furnaces and soaking pits. In this way it has been proved possible to take in ironstone at one end of the works and turn out finished steel sections at the other, using no more coal than must be charged into the coke-ovens to make the necessary amount of coke for the blast furnaces.

Translated into figures, this means that, whereas formerly, under the old plan, it was necessary to consume altogether not less than 2·35 tons of coal per ton of iron converted into finished steel sections, it is now possible, under the new arrangements, to effect the same ultimate result with an expenditure of no more than 1·6 tons of coal, or, in other words, to effect a net saving of 0·75 ton of coal per ton of iron produced. If this were universally achieved, it would involve a saving equivalent to about one-third of the 30,000,000 tons of coal annually consumed in British iron and steel works at the outbreak of the war. But even the universal achievement of these new reforms will not exhaust all the possible economies in the production of iron and steel. There will still remain to be dealt with at least one prominent item of present loss—namely, the heat contained in the molten slag running from the blast-furnaces. This is probably equivalent to between 8 and 12 per cent. of the calorific value of the coke charged into the furnaces, according to the richness and character of the ore smelted. The problem of turning this to good account is beset with technical difficulties; but already a beginning has been made in at least one British establishment to deal with all details, and success will be eventually achieved.

At the outset of my first lecture, I ventured to express the opinion that "with an efficient and systematic public supervision and control of fuel consumptions, we ought to be able, even with existing appliances, to save many millions of our annual coal bill, and, with improved methods and organization, still more millions." I have endeavoured to fully explain the grounds on which this opinion is based, and to indicate the chief directions in which such huge economies may be achieved. I have not consciously exaggerated either the magnitude of possible saving or the gravity and urgency of the case from a national point of view.

The last Royal Commission on Coal Supplies reported, in 1905, after an exhaustive inquiry, that, on the basis of Mr. Beilby's estimate, the possible saving in our then annual coal consumption amounted to between 40,000,000 and 60,000,000 tons; and, if my rough estimate is anywhere near the mark, the margin is probably not much less to-day. Truly in matters of national saving we "strain at gnats and swallow camels." There is no excuse for the inaction of our rulers during the past ten years, because the report of the Royal Commission was "presented to both Houses of Parliament by Command of His Majesty." Those were the piping days of peace and plenty, when we thought but little of the morrow; but now that war has brought us face to face with the stern realities of the case, let it not be said to our shame by posterity that we knew our duty in the matter and did it not.

OUR BRITISH PATENT LAWS

AND THEIR BEARING ON FUTURE GERMAN TRADE.

By JAMES KEITH, Assoc.M.Inst.C.E., M.I.Mech.E., &c.

DURING the past twenty-five years or thereby some of us have done our best, in season and out of season, by pamphlet, brochure, in Parliament, and by communications to the Press, to impress our legislators with the importance of putting our British patent system on a better footing for the benefit of British inventors and for the general progressive business of the Empire.

Notwithstanding frequent revision of the patent law, we have only yet attained to an elementary form of qualified search, and have not yet succeeded in throwing off the burden of patent taxes, which still remain to the injury and discouragement of British invention and British trade.

The first revolution in our patent system was in 1883, when the late Right Honourable Joseph Chamberlain, M.P. (a "business" man), while President of the Board of Trade, framed and carried the "Patents, Designs, and Trade Marks Act, 1883," which, although an immense improvement on the old Act of 1852, had many serious faults, such as the continuation of the heavy renewal fees, though payable in a different way, too short a period for the duration of the patent, and failure to provide any form of search, with the consequent absence of any certainty of protection to the inventor.

Passing over the Amending Acts of 1884, 1886, 1888, 1901, and 1902, of minor importance, a second revolution was effected or promised by the much-belauded Patent Act of 1907, formulated and carried by the Right Honourable D. Lloyd George, M.P. (a "lawyer"), President of the Board of Trade, the success of which is still to seek.

If the Act of 1883 was revolutionary in one sense, the Lloyd George Act of 1907 was even more revolutionary in quite another and more harmful sense. And undoubtedly it is to the practical ignorance displayed in the framing of the Act of 1907, and its ridiculous provisions, that most of our present grievances (and especially as regards Germans) have arisen.

Hitherto, all previous British Patent Acts except that of 1907 had the redeeming quality of catholicity in their not insisting on the working in this country of a British patent granted to a foreigner; and in this broad-minded and non-parochial sense they corresponded with the patent system in vogue in the United States, which system has proved so successful in comparison with the systems of all other countries. Why Mr. Lloyd George should have followed the lead of an autocratic country like Germany in this sense, instead of that of a progressive nationality like the United States, has always been somewhat of a mystery—more especially seeing that the very precautions he apparently took to keep down German competition actually were the means of bringing, if not inviting, numbers of Germans over to Great Britain, ostensibly for the working of British patents granted to Germans, but practically to act as spies, as since the war we have discovered to our cost.

Arising out of these provisions in the Act of 1907 (as quite natural to Germans), the Germans quickly adopted reprisals against British owners of patents in Germany—bringing into force additional provisions for compulsory working in Germany, and at the same time making it actually almost futile for British inventors to seek patents in Germany; while Americans applying for patents in Germany obtained special privileges, because of the freedom from obligation to work patents granted in America to foreign owners of United States patents.

The Act of 1907, with the Act of 1914 and rules made thereunder—after the war had begun—are responsible for the following present grievances:

1.—The Comptroller of the British Patent Office has not apparently the power to refuse acceptance of any application for a British patent, even although a patent for the identical invention may have been granted and published years before in a foreign country.

Any British inventor prejudiced by the issue of the patent must simply accept the situation; his only recourse being to institute proceedings in Court after the invalid British patent has been sealed.

Note.—The International Convention allows only a term of twelve months for filing a British application for an invention patented abroad; and no British inventor under the same convention rules has more than twelve months in which to file a foreign application for his invention patented in this country.

2.—Any German desiring to appropriate a British invention for which a British patent has been granted to a British inventor may do so in the following circumstances:

Supposing the British inventor applies within twelve months for a patent in Germany for his invention, his application may be successfully opposed there on one ground or another, and a decision issued in circumstances such that the British applicant cannot secure a hearing.

In the case of an opposition to a British application of a German subject, proceedings are postponed to the end of the war.

Note.—These privileges to foreigners are absolutely one-sided, so far as the ending of the war goes, though the foreigner's accepted British application cannot be sealed till the end of the war.

3.—Under the 1907 Patent Act, anything known or unknown for which a patent is applied in this country, however impracticable (for which a British patent specification has not been filed in the British Patent Office Library during fifty years before the date of application), is entitled to British patent protection—51 years' anticipation does not count.

Note.—These cases are not in any way hypothetical, but are taken from examples at the present time in actual existence.

After the passing of the 1883 Act of Parliament, there were great expectations that the result would be an increase in the number of "Applications for Patents." These expectations were fully justified, as in 1884, when the new Act came into force, the number of applications had increased by nearly three times the number in the previous year; while by 1889, or after six years, the patent applications had increased by nearly four times, and by 1897 the number had reached something like 31,000, or over 500 per cent. more than the applications in 1883 under the old Act. This number has practically been the high-water mark ever since. Certainly the 1907 Act, so much boomed by its author and the Press at the time of its introduction, has most lamentably failed to increase progressively, as expected, the number of applications for letters patent.

It is satisfactory to note that in the "Death Knell of German Trade" debate, which took place in the House of Commons on January 10, Mr. Runciman (the President of the Board of Trade, who controls the British Patent Office) pledged himself in the following words:

> I also agree that we must overhaul once more our patent system and our copyright laws.

This, however, is only a paraphrase of what his predecessor at the Board of Trade (the Right Honourable Mr. Ritchie, M.P.), stated before the Associated Chambers of Commerce in 1900—nearly 16 years ago. So it may still be necessary to keep our new President of the Board of Trade this time strictly to his pledge.

In the same great speech, Mr. Runciman further said:

> During the war we should do everything to destroy German credit; and to that end we should do everything in our power to cripple, cramp, squeeze, and destroy her trade.
>
> We must see to it that, having ended this war victoriously, we do not give Germany a chance of reconstructing her commercial position. One of the first necessities of this country, if she is to hold her own during times of war, and when war is over, is that we must improve our research methods.

These are brave and strong words to come from the President of the Board of Trade; but, to show earnestness, the first thing to be done should be the immediate scrapping of all rules so generously arranged by our Government for the benefit of the Germans since the war started.

Invention, which is the life and soul of progress to any nation, should be welcomed and encouraged, as unfortunately it is not under our present patent procedure; and, in the "overhauling" again of our patent system (foreshadowed by Mr. Runciman) there should, among other things, be included:

1.—A real search to ensure novelty and validity, before any application for a patent be entertained.
2.—No patent to be granted unless novel or practicable.
3.—The entire abolition of all renewal fees. } Both as in the United States.
4.—The extension of the period for each patent from fourteen to seventeen years. }
5.—Some form of a guarantee for a *boná-fide* inventor.
6.—Simplified Court procedure in patent cases, so as to limit the frightful expense of patent litigation.

Note.—In the formulation of any new Patent Act, inventors, engineers, and business men should be called into consultation more than Patent-Counsel, Lawyers, and Patent Agents, as has hitherto been the case.

Then, with the indispensable "Minister of Commerce or Industry," so long rightly clamoured for by the Chambers of Commerce and other representative bodies throughout the United Kingdom, and these moderate advantages enumerated, Great Britain, after the war, would be brought into something like line with the United States—its principal future competitor in the world's trade—and so have every chance of holding its own.

The policy of Germany at the present time appears to be to uphold at any cost its present trade and its future outside commerce in this and in every other country.

The world now knows how the Germans look upon agreements, what double-dyed pirates they have proved themselves to be at sea, and some of us at least know they are equally piratical or "Hunnish" in their business transactions on land everywhere.

So far therefore as Germany and Austria are concerned, "laissez faire" policy must go by the board, and Teutonic trade and business of all kind must be absolutely "barred" for, at any rate, all our time.

NATIONAL ILLUMINATION COMMITTEE OF GREAT BRITAIN.

Report of the Chairman.

At the Special Annual Meeting of the Committee of the National Illumination Committee of Great Britain, held on the 27th ult., the Chairman (Mr. William Duddell) presented his report, in the course of which he said that the year 1915 was somewhat uneventful in the life of the Committee, as a great part of the international work which was contemplated had to be wholly suspended. The Committee sustained the loss by death in July of its Chairman, Mr. Edward Allen, of Liverpool. The Committee chose him (Mr. Duddell) to be Chairman, and Mr. John Bond as one of the Vice-Chairmen. During the year the Committee met twice. At the first meeting Mr. Trotter's proposal was adopted, that the Committee should invite the National Physical Laboratory and teaching institutions to determine the height of the amyl-acetate flame which affords the light of one standard candle.

This appeal resulted in reports from Dr. Houstoun, Professor Mather, Professor Marchant, and Professor Morris; while Mr. Trotter made a comparison of the results obtained and which results are now under consideration by the Committee and the experimenters. A paper by Dr. Ott, of Zurich, on the "Effect of Variations in Atmospheric Conditions on the Light of the Hefner Lamp," was received, and, with Dr. Ott's consent, it was published in the Technical Press. [It appeared in the "JOURNAL" for Nov. 16 last, p. 378.] It seems improbable, the report concluded, that international co-operation will be obtainable to any reasonable extent during the present year; and the National Committee will, Mr. Duddell thinks, continue its work on the subjects that are already before it.

SOCIETY OF ENGINEERS.

Presidential Address of Mr. Percy Griffith.

At last evening's meeting of the Society of Engineers, which was held at Caxton Hall, Westminster, Mr. PERCY GRIFFITH, M.Inst.C.E., delivered his Inaugural Address, on taking, for the second time, the office of President—the previous occasion being fourteen years ago.

He first dealt with the status of the engineering profession; urging that it is necessary to educate the public as to the functions, qualifications, rules of conduct, and basis for remuneration of the various classes of engineers; and, secondly, that this education of the public, as well as the settlement of questions affecting engineers in their relationship one to another, calls for the establishment of a new organization constituted on somewhat different lines from the various institutions at present existing, the chief purpose of which is the discussion of technical problems arising in the exercise of professional duties.

The portions of the address dealing specifically with gas supply and water supply were in the following terms.

GAS SUPPLY.

Reference to the subjects mentioned in my previous address will afford striking evidence of the progress made in this branch of engineering during the past fourteen years. What was then described as a "fair prospect" of "seeing the flat-flame burner displaced by the incandescent burner," is now, for all practical purposes, an accomplished fact. The then vague possibility of heating power being substituted for illuminating power as a criterion of statutory test is also now normal practice, though the cost of manufacture under modern conditions has not been reduced to the extent which at that time seemed probable. Nevertheless, a marked increase has been obtained in the yield of gas per ton of coal; the then normal average of 10,000 cubic feet per ton having advanced to a figure approaching 13,000 cubic feet per ton, without, of course, including water gas.

The supervision of consumers' fittings, which in 1902 was something of a novelty, is now universally undertaken, generally at charges which barely cover the actual cost; and the hiring-out of stoves, fires, and fittings, combined with the use of slot or prepayment meters, described then as a "recent practice," is now developed until the amount of capital employed in this way forms a very appreciable proportion of the whole capital employed, and the proportion of slot consumers has risen from an average of 25 per cent. to an average of 50 per cent. High-pressure lighting for streets, shop-fronts, and large open or covered spaces has steadily developed; maintaining, if not improving, its position relative to electric light. While the Scott-Snell automatic high-pressure lamp, which in 1902 seemed to have a brilliant prospect of success, has failed to stand the test of time, the inverted gas-burner, then a novelty, is now in common use, and has more than fulfilled the expectations of its progenitors.

The most conspicuous developments in connection with carbonizing plant are vertical retort-settings (both continuous and intermittent), and the extended use of machinery for handling coal and coke, particularly machines for charging and drawing horizontal retorts. In regard to administration, the delivery of gas through high-pressure trunk mains, enabling it to be conveyed long distances in mains of relatively small diameter, has tended to develop the centralization of carbonizing works, and the amalgamation of adjacent undertakings; and further development in this direction appears likely in the future.

The war has opened a very brilliant future for the important bye-product tar, which has secured an immediate market as a source of the high explosives used in munitions, and has also, owing to the temporary cutting-off of the supply of chemicals and dyes from Germany, and the scientific development of this industry in Great Britain which will, it is hoped, follow, obtained a still brighter prospect for the future. The application of gas to manufacturing processes requiring a readily-controlled source of heat has also made rapid strides; and in every respect the future prospects of this important industry are such as the energy, ingenuity, and resourcefulness of English gas engineers have amply merited.

WATER SUPPLY.

On turning to that branch of the profession with which I have been most intimately associated, it is perhaps not without interest to recall the remarks contained in my Presidential Address of 1902, if only for the purpose of observing the progress made in the intervening years. This is the more easy because in a Blue-Book recently issued by the Local Government Board the present position in regard to some of the more general features of the water supply of this country, to which I specially referred in 1902, will be found to be clearly stated. From the preliminary memorandum preceding the statistical information contained in this, it will be seen that there has been no general water supply legislation during this interval, though the Blue-Book itself may be considered as a preliminary step in this direction. It is a matter for regret that the Legislature should exhibit such palpable reluctance to deal with problems of a domestic character, and yet devote so much energy to political problems which are, in many cases, of much less importance to the well-being of the community at large.

Take, for example, the question of responsibilty for providing a public supply of water. As far back as 1878, the Select Committee on the Public Health (Water) Act of that year made several recommendations calculated to facilitate the action of local sanitary authorities in securing or providing supplies of water for their districts; but for the most part similar recommendations are repeated in the Blue-Book above referred to—thus showing that defects admitted in 1878 remain uncorrected in 1915. Similarly in the case of areas of supply, and the difficulties of combining sanitary districts for water supply purposes, the present condition of affairs is practically the same as in 1902, except for a few isolated cases where Joint Water Boards have been created for large and populous areas. As Mr. Henry C. Adams (Vice-President) has pointed out in his Presidential Address to the Institution of Municipal Engineers, there is urgent need of legislation to facilitate, and under certain circumstances to compel, the union of adjacent rural parishes for schemes of water supply.

In connection with the allocation of sources of supply and the need for a permanent central authority to deal with this matter on certain well-defined principles, in contradistinction to the present method of settling such questions in Select Committees of the Houses of Parliament, the position has remained unaltered, in spite of many reiterated recommendations of Royal Commissions, Government Departments, and Parliamentary Committees, to say nothing of influential public bodies such as the County Councils Association, the Institution of Water Engineers, &c. In regard to municipalization, some progress has been made by private legislation transferring particular undertakings to the local authorities of the district; but no general legislation has been promoted to transfer to local authorities areas which, although included in the statutory limits of company undertakings, are not supplied with water on account of the available revenue in water-rates being less than the amount prescribed in the Water-Works Clauses Act, 1847, nor to permit local authorities to make up the prescribed revenue out of the general rate.

On all such general questions, the position has not changed since I last occupied this chair; and it must, I think, be admitted that, in matters of this kind, our national tendency to wait for a serious emergency before remedying known defects, has proved a great disadvantage. At the present moment, however, it may be confidently hoped that, after the rude awakening which the nation has experienced in connection with its most vital interests, the policy of *laissez-faire* will be entirely abandoned, and when relieved from the strain imposed by the war, the nation (and particularly the Legislature) will make a point of dealing promptly with all domestic questions in connection with which defects are discovered or improvements are called for.

In regard to water-works, there is at the moment little progress to record, as expenditure on public works of this nature has been ruthlessly curtailed on account of the war. Nevertheless, I feel bound, not only in the interests of my *confrères*, but also in the public interest, to suggest that water and sanitary authorities should not allow this period of "suspended animation" to be wasted. There are many cases in which urgent works will have to be undertaken or resumed immediately the war is over; and the relatively small amount of expenditure involved in the preparation of plans and specifications might with advantage be incurred at once. Where the local water authorities do not take the initiative in this direction, it may reasonably be urged that the Local Government Board should use their influence to press forward the preliminary work in question. I would even suggest that in most cases engineers would be glad to do the work now rather than later on, if only to occupy such of their assistants as are beyond the military age, and that the payment of fees could be deferred until the war is over.

In connection with works of water supply, recent practice has exhibited little in the way of novelty. Public attention is, of course, attracted mainly by the larger works, particularly those involving the construction of impounding reservoirs. But, meanwhile, the most intricate and interesting problems are constantly being solved under circumstances which are not favourable to publicity; and the engineer engaged on smaller works has the satisfaction of gaining experience in many complex details of water-works practice which escape the notice of those absorbed in designing larger and more costly schemes. I therefore desire to urge upon such of my *confrères* as practise in small works to make a point of publishing their experiences in the form of papers, and to realize that, with the exception of the Institution of Water Engineers, this Society is the most appropriate means of securing their publication and discussion.

While but little novelty is to be found in works of water supply generally, a great deal of useful and unobtrusive research has been carried on in connection with the filtration of supplies derived from sources liable to pollution. The increasing use of mechanical filters may be taken as the practical issue of this research; but it must not be assumed that this practice alone affords a solution of the problems involved. The experiments carried out by Dr. Houston for the Metropolitan Water Board have proved the enormous and unexpected effects of simple storage, and have also demonstrated the efficiency of treatment with an excess of lime followed by sedimentation and efficient filtration, thus involving a softening of the water at the same time. Intelligent combination of old and new methods is also well illustrated by the successful application of mechanical filters in conjunction with slow sand filters, and also by the Puech system, in which the filter-beds are arranged in sequence, commencing with those where gravel is used as the filtering medium, and ending with those where fine sand is employed.

While dealing with the question of filtration, it may be worth while to consider the broader question of the conditions necessary to warrant a water being regarded as suitable for ordinary domestic use, or, in other words, as "a pure and wholesome water," as defined in the Water-Works Clauses Act, 1847. In a paper presented to the Institution of Water Engineers in June, 1914, Professor S. Delépine, of the Manchester University, describing the standard results to be required of any modern filtration plant, suggested some tests for filter effluents which may be accepted as a safe and practical definition of what "a pure and wholesome water" should be. I therefore venture to reproduce these tests as being applicable—with some obvious exceptions—to all water supplies whether they are artificially filtered or not. [See "JOURNAL," Vol. CXXVII., p. 108.]

AMERICAN ILLUMINATING ENGINEERING SOCIETY.

Mid-Winter Convention.

This Meeting is being held during the present week in the Engineering Societies Building, New York. The feature of the Convention is expected to be the attendance of Mr. Thomas Alva Edison, who will be asked, at a banquet that is to be tendered to him on Thursday evening, to accept honorary membership of the Society.

In issuing the programme of proceedings, the Chairman of the Convention Committee (Mr. Arthur Williams) says that the list of papers to be presented showed a wide range of subjects. There was to be a review and record of what has been accomplished in the art and science of illuminating engineering, and it was hoped the discussion would "bring forth plans for the future advance of the art"—the Society expecting "a year of greater activity than ever before in all the fields that have been covered."

On Friday afternoon a popular lecture is to be given by Mr. W. D'Arcy Ryan, the designer of the lighting of the Panama Pacific Exposition. This will be illustrated by coloured transparencies, 24 feet by 36 feet, which it is said will convey more fully to those who did not visit the exposition the wonderful lighting effects produced with colour.

Among the papers mentioned in the programme are the following: "Relation of Lighting to Architectural Interiors," by Professor Morgan Brooks. "Theatre Lighting," by Mr. Bassett Jones. "Illuminating Engineering Photographs," by Mr. B. H. Norris. "Lighting of the General Offices of the Consolidated Gas and the New York Edison Companies, Consolidated Gas Building, New York City," by Messrs. Thomas Scofield and Clarence L. Law. "Gas Lighting of a Large Cathedral in Philadelphia," by Mr. J. D. Lee. "An 'Average Eye' for Heterochromatic Photometry, and a Comparison of a Flicker and an Equality-of-Brightness Photometer," by Messrs. E. C. Crittenden and F. K. Richtmyer. "An Integrating Sphere," by Messrs. E. B. Rosa and A. H. Taylor. "The Box Photometer," by Professor L. O. Grondahl.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the Wandsworth Gas-Works.

About forty members of the London and Southern District Junior Gas Association spent a busy afternoon on Saturday at the Wandsworth works of the Wandsworth, Wimbledon, and Epsom District Gas Company. In the unavoidable absence of Mr. H. O. Carr, the Company's Chief Engineer, the visitors were welcomed by Mr. C. M. Croft, the Assistant-Engineer, who, with Mr. S. J. Oxer (Chief Draughtsman) and Mr. G. Gardiner, took the various parties over the works. It may be remarked that this is the second occasion on which the Company have extended their hospitality to the Junior Association; the previous visit having taken place in October, 1907. In June, 1913, also, when Mr. Carr was President, the Southern District Association of Gas Engineers and Managers went over the works, particulars of which, in connection with both events, were given in the "JOURNAL" at the time. Since the full description which was published in the number for May 27, 1913, p. 586., there have been some additions and alterations; but in the main, of course, the works are as they then were.

One of the features on which the visitors last Saturday agreed that the Company are to be congratulated is the large amount of ground available. Another is the favourable situation of the land. As a matter of fact, out of some 23 acres, only about 11 acres are at present occupied, leaving over one-half of the site available for further extensions. The manufacturing capacity is nearly 9 million cubic feet per twenty-four hours. The members were first shown the means by which the whole of the coal required by the Company is brought into the works, which have a large frontage on the River Thames, and also a canal leading from it. The coal when it arrives in the Company's own colliers is unloaded into barges, and brought alongside as required, for placing into store; that needed for the Mitcham and Epsom works being subsequently conveyed there by Foden steam-waggons. These steam-waggons are being run entirely on coke, which is found to be very satisfactory, as well, of course, as a highly convenient fuel from the Company's point of view. As to the unloading of the coal from the sea-going steamers, in connection with this attention was drawn to three Belgian barges, of a capacity of 750 tons each, which have been acquired by the Company. These came from Antwerp shortly before the Germans took possession of the city. At the present time the coal-handling arrangements are being extended by the provision of a 100-ton an hour Gibbons bucket conveyor; and there is to be a large hopper for taking the Mitcham and Epsom coal.

There are two retort-houses; but one of them—in which the two benches of eight settings of six retorts are heated by direct fires, having one furnace on each side of the setting—is treated as a stand-by, and is not now in use. The house in which the coal gas is being produced is 377 feet long, and 65 feet wide, containing 35 beds of ten retorts. The settings are of the regenerative type, with single furnaces all arranged on one side of the sets only. De Brouwer and Fiddes-Aldridge stoking machines are to be seen working side by side in this house. Full retorts are worked—15 cwt., and ten-hour charges. A visit was paid to the power-house, where the means for generating electric current for use on the works were seen to be of a very complete character. The scrubbers, which are filled with wood grids, were noticed; and the purifying arrangements were explained. There are nine purifiers, eight of them, 40 ft. by 36 ft. by 8 ft. deep, under one roof. Five tiers of oxide are used; and the flow of gas is broken into three streams.

The sulphate plant, with a capacity of producing about 5 tons of sulphate of ammonia per 24 hours, was not overlooked; neither were the water supply arrangements of the works. Water is derived from both the river and from an artesian well 430 feet deep. That from the river is raised by pumps driven by a gas-engine; while the artesian well water is lifted by means of compressed air. The sulphate plant consists of two stills working on the intermittent system, and connected to a superheater and two Coffey stills. There are two saturators, one of which is fitted with a steam ejector. There is a naphthalene extractor 10 feet square and 30 feet high, fitted with spreaders on top, as in the case of ordinary scrubbers; the base of the extractor being used as a tank. The method of working adopted is the circulation by a pump of carburetted water-gas tar from the tank at the bottom to the spreaders at the top. Speaking of water-gas tar leads to mention of the fact that there are on the works two sets of carburetted water-gas plant, made by Messrs. Humphreys and Glasgow on the Lowe system, which have a combined capacity of 1,800,000 cubic feet of gas per day. The coke is elevated to the stage floor by hydraulic lift. Oil is pumped direct from barges into the storage tanks. There are four station-meters, in a house constructed of "Hy-Rib" material, plastered on both sides. Keith-Blackman boosting plant is capable of raising half-a-million cubic feet of gas per hour 12 inches above the initial pressure of the holders. From the governor-house, there are four 30-inch outlet mains to the district.

A large Head-Wrightson "Notanos" washer, of a capacity of 10 tons an hour, separates the coke and breeze from the clinker. This is arranged at such a height that the Foden steam-waggons can run into what is practically a tunnel under the storage receptacles, with openings in the top, from which they are filled. The water used in the washer passes down into a settling tank at the bottom, from which it is afterwards pumped up for use over and over again. Another thing which the visitors were able to inspect was a new Hird-Chambers tar dehydrating plant.

The inspection concluded with the workshops—blacksmiths', fitters', carpenters', &c.—and the stove shops. The latter are in a building on the site of the old gas-works, which was originally a retort-house, with a coal-store running the entire length of each side. The retort-house and one of the coal-stores make stove-repairing shops of dimensions which certainly filled some of the visitors with envy. They had explained to them the method adopted of burning-off stoves in two ovens, and the processes of "Bower-Barffing" and re-tinning various stove parts and articles. The coal-store on the other side of this old retort-house has been converted into offices for the inspectors and inspectors' clerks; and at the conclusion of the tour round the works, the different parties joined-up in these offices, where they found tea awaiting. During this portion of the proceedings, Mr. Carr returned to the works, and at once came along to greet the members.

The President (Mr. S. B. Chandler, of the South Suburban Gas Company) remarked that they had had a very instructive visit. At such a time as the present, the Association should be particularly grateful to those companies who were so good as to allow them to go over their works on a Saturday afternoon. They had seen that the Wandsworth Company were very busy, and knew that they were able to sell gas at a cheap rate. They all regretted very much that Mr. Carr had been unable to be present during the early part of the afternoon; but the members knew how much occupied he was. The thanks of the Association were due to the Directors and Mr. Carr. They had not only been permitted to go over the works, but had been received in a very hospitable manner. Their thanks were also specially due to those gentlemen who had conducted them round, and shown them all there was to be seen.

Mr. F. Pearce (the Senior Vice-President) proposed a hearty vote of thanks to the Directors of the Company, and to Mr. Carr, Mr. Croft, and the other members of the staff who had been with them during the afternoon. The members were, he said, exceedingly grateful for the pleasant and instructive time they had spent. They had seen under every-day conditions the works of a Company supplying a large district with gas under favourable conditions as to price.

Mr. D. C. Cross, in seconding, expressed the opinion that it had been one of the most enjoyable visits to a gas-works which the Association had taken part in. Some of the ingenious things they had seen gave them an idea as to how it was the Company found themselves in a position to sell gas at so moderate a price.

Mr. Croft, in acknowledging the cordially passed vote of thanks, said it had been a great pleasure to him to show the members round, as he was sure it would also have been to Mr. Carr had he been able to be with them. One of the Company's steamers had been expected to arrive during the day; and he was rather sorry it had not done so, because they would then have been able to see something of their methods of unloading.

Mr. Carr, on being asked by the President to say a few words, remarked that he was delighted to see the members at the works; and if they wished to come again on a future occasion, the Directors would be quite as pleased for them to do so as they were now—and so would he personally be. It was always a pleasure to the engineers of works to be of assistance to Associations like theirs; and such visits were of great value, because the actual practice of one works differed very largely from that of another. No doubt, they had observed this for themselves. Circumstances altered cases; and it was necessary to mould one's practice to the circumstances under which one was working. He could not say of the Wandsworth works that they were anything of a show works. The chief virtue they possessed was that they were able to furnish a fairly cheap supply of gas; and, after all, this was really the main thing. He wished they had the time and labour, not to decorate the works, but to make them neat. It would have been easy; but there was a war on, and this was the trouble. From his experience in the district the Government had been good enough to ask him to look after in regard to high explosives, he was happy to say that practically every gas undertaking, where it was possible to do so, whether municipal or company, had really done its level-best to get the highest extraction it could by the means it had at hand. In no instance could he find that they were making any profit, but, on the other hand, usually a considerable loss. He would again like to say how glad he was to see the members there. His Directors, too, were always pleased, and would always be pleased, to allow the members to go and see any of the works of the Company, provided the Association thought them of sufficient interest to justify a visit.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Meeting at Dunfermline.

A Meeting of the Eastern District Section of the Scottish Junior Gas Association was held at the Gas-Works, Dunfermline, last Saturday, when there was a large attendance.

Inspection of the Gas-Works.

Previous to the meeting, Mr. Alexander Waddell, the Manager of the Dunfermline Gas-Works, conducted the members over the place, pointing out the additions and improvements necessitated by the extension of the gas undertaking to Rosyth. Visits were made to the new purifier, the exhauster room, and the new retorts. There are four new vertical retorts working at present, and, in addition to these, twelve others are being erected. It is hoped that great improvements in the working will be effected in connection with the new retorts. When the extensions are completed, the works will be able to produce 4,000,000 cubic feet of gas per day. The principal feature of the new purifiers is that they are deeper than the ordinary ones; and they have been so constructed that the gas can be either sent up or down or split into two—one stream going up and the other down in each purifier. The idea of handling the purifier material is to drop it down through the bottom at four different places, and gather it up in barrows. The barrows are to run into the cages and carry off the material to be put into the boxes. The barrows are lifted by a double-jibbed crane. In the new buildings, the lines of those put up by Mr. Newbigging have been followed.

The Business Meeting.

At the meeting held later,

The President (Mr. J. Scott) said the large turn-out showed that the Eastern branch of the Association was still alive. No doubt the visit to Dunfermline was the cause of the good attendance. It was a great pleasure to be present that day to see the improvements which, under Mr. Waddell's engineering skill, were being carried out, in view of the developments at Rosyth. It was fitting that he should mention the loss by death since their last meeting of Mr. O'Connor, who had been one of their honorary members, and a very great asset to the Association. He was sure he voiced the feeling of the Association when he said that they missed Mr. O'Connor very much. He was glad to welcome, among others, to the meeting Mr. Fulton, of Helensburgh, the President of the Western district.

Mr. Mackie Darling (Aberdour) read the following paper:

GAS SUPPLY TO A NEW DISTRICT.

Having been prevailed upon by our President to contribute to the proceedings of this session, I intend to give you a brief description of the introduction of a gas supply to the sea-side village of Aberdour, which I have had charge of. It is so recent since Mr. J. D. Luck, of Markinch, gave a very interesting paper on the same subject, that I may be compelled to duplicate much of his information. Yet there may be some points of interest that may appeal to you.

Although Aberdour lies within easy reach of various surrounding gas-works, no one had ventured to lead a supply of gas thereto, until invited to do so by the Dunfermline District Committee of the Fife County Council; and the successful offerers were the Cowdenbeath Gas Company, by whom I was employed at the time. Till this time oil-lamps, and in one or two cases petrol air gas, held the field. The streets also were lit (when the moon did not appear) with oil-lamps fixed in ordinary gas-lanterns, mostly on cast-iron pillars—a few being fixed to the walls with brackets. Aberdour by this time had become a favourite summer resort, and, further, quite a number of important personages connected with the Naval Base at Rosyth had been attracted to, and taken up residence in, the village; and, naturally, the inhabitants wanted a more up-to-date system of lighting. The subject had been discussed by the inhabitants for fully 20 years, so at last the District Committee decided to introduce gas.

High-pressure supply is no new thing at Cowdenbeath—a supply to the village of Crossgates having been in operation for quite a number of years; so that the Aberdour system was simply an extension of the existing supply. My work did not bring me in close contact with the high-pressure main, so I do not intend to deal with it, but rather to confine myself to the part which came immediately within my scope. As you all know, the first work to be done in connection with a scheme of this kind is to get the street mains laid. I took up my duties at Aberdour early in June, 1914, so as to be able to commence operations along with the contractor who was to do the excavating work. I wish you to take particular note of the date of commencing the work, June 7, 1914, as the District Committee expected us to have all the street-lamps, 58 in number, lit on Aug. 15. Our Manager preferred to do the pipe laying and jointing with our own staff; so that this occupied a considerable part of my time, besides supervising the contractor's work in excavating and re-filling the track.

The pipes were from Messrs. Stewarts and Lloyds, and were of their well-known type—steel, with long sleeve joints. The water-traps and specials are all of cast iron; being cast with long sockets, and of smaller diameter than usual to take the steel main, and leaving only the same space for jointing material as the joints on the mains themselves. The jointing material used was ordinary spun rope yarn and molten lead. Some of you may ask why we did not use the more up-to-date lead wool for jointing; but it seems our Manager still considered molten lead quite as efficient as lead wool. One point I might mention—that before driving home each length, the spigot end was coated with tar (which made the pipe glide in much easier, and also filled up any space between the metals and helped to make a joint in itself), then the rope yarn was driven home, followed by the molten lead.

At one point in the district a bridge over the Edinburgh to Dundee main railway had to be crossed. On examination by the Railway Engineer, however, it was found to be impossible to get our pipe over the bridge on the roadway. An alternative scheme was put forward by the Railway Engineer—viz., to allow us to lay the pipe through the goods station, thence under the rails of the same line, and then on to the main roadway at a point further on than the bridge mentioned above. This was agreed to. In crossing under the main line, to avoid having any joint under the railway track, we obtained a 30-feet length of pipe, which carried us right across both sets of rails. The pipe at this point is

3 ft. 9 in. under the rails, so there should not be much danger of heavy trains disturbing the joints. At another point we had to cross another bridge over the same line. In this case we did get across the bridge, but with nothing to spare. From the crown of the bridge to the level of the road there is a depth of only 11 inches. To make sure of having the pipe protected, we filled in this point of the track with concrete. Altogether 3832 yards of mains were laid, consisting of 887 yards of 5-inch, 961 yards of 4-inch, and 1984 yards of 3-inch and 2-inch.

The next part of the work to claim my attention was the erection of nineteen new lamp pillars and the re-erection of many of the existing pillars to bring them into proper line. This was followed by connecting them up to the main pipe. At some points the lamps were erected on the opposite side of the street from the main; so that I had to cross the street with each service-pipe, to avoid having to cross the road when I started on lead services into the houses and shops. I ran a 1½-inch service across to each lamp, and put on T-pieces before reducing to ½ inch to go up the pillars.

On examining the old lanterns, it was discovered that a number of them were useless for up-to-date incandescent lighting; so it was arranged to scrap the lot and get new ones. These were supplied by Messrs. Alder and Mackay, of Edinburgh. They are of very neat design. The only parts that are seen from the street are the controller on the bottom and the mantle hanging from the top—the brass tube from the controller to the burner going up a corner of the lantern. Each lamp is fitted with a stop cock; so that the gas can be shut off during the summer without interfering with the controller. The lamps are lit and extinguished by the firm's pressure wave controllers. So expeditiously was this part of the work carried through, together with that of laying forward the 4½ miles of high-pressure main (which was under a separate contract), that we were able to light 57 out of the 58 lamps on the date fixed by the District Committee—viz., Aug. 15, 1914.

Having completed the street mains and public lamps, I next turned attention to the laying of service-pipes to shops and private houses. The road authorities had decided to lay the principal thoroughfares with tar-macadam; but owing to our operations, they delayed the work, and now they asked us to complete the whole of our pipe laying, so that the newly-laid macadam might not be cut up by us making further connections. As the road authorities had been put to some inconvenience through delay, we decided to try and meet them in this matter, and it also allowed us to get all the tracks made good once and for all. Therefore, a careful survey of all the houses and buildings was made, and a scheme of service-piping mapped out so that all would have a good supply, at the same time saving as much pipe and time as possible. Pipes were laid across the street as far as the footpaths to all buildings, whether gas had been applied for or not; and the result has been rather surprising. It would appear that the nearer you take a gas supply to people's door the more chance you have of getting consumers, as at the present time there are very few of these cross-services lying idle. Some people asked us why we were laying a gas-pipe to their house when they had not asked for gas. The reply was that we were only getting ready, as we expected they would be asking for gas before very long; and in most cases this had the desired effect.

Before the Company offered for the gas supply, the Manager made up a statement of the number of houses, shops, workshops, &c., which might be taken as possible consumers. This worked out at a total of 436. To-day, after eighteen months' work, we have secured 315 of this number, and others are coming in slowly. The connecting of the service to the main is always an important part of the work; and here I can only repeat what was said by Mr. Luck at Edinburgh—we use the same saddle connection as was described and shown.

The placing and fixing of meters is also of importance; and we were careful to let it be known that we only were to decide where meters might be placed. The reason this step was taken was that we often found plumbers arranging for meters in bed-rooms and such places, causing a great deal of inconvenience if a connection for a cooker or fire is wanted, and also for meter reading. The fixing of the meter in many cases is the end of the gas company's work, but not so with us. During the time we were laying the mains and service-pipes, we also had a staff of gas-fitters fitting-up the houses. This work, of course, is all charged for. In most cases estimates were furnished in the usual way and accepted before the work was commenced, and many times we competed with the local plumbers.

It is a decided advantage to the consumer to have all the fitting work done by the gas company, because if there is anything wrong the blame rests entirely with the one party. Another advantage is we in almost all cases make provision for a cooker and fire connection; and it is to our credit to see that only the best material is supplied. Out of 315 consumers we have done the gas-fitting for 294; the total value of the work amounting to roughly £720. In addition to this, we have fixed free of charge 135 gas-cookers, 26 hotplates, and 112 rings and grillers. There have also been fixed eight gas-fires, two geysers, two gas-engines, and four gas-irons.

I am afraid I have given you a very general description of the scheme; but time will not permit me to enter on fuller detail of any particular head. Before closing, I would like to describe in a few words the gas supply itself. After getting a piece of ground, the Company decided to erect a gasholder at Aberdour. This, of course, was not ready on Aug. 15, when the gas was turned on; so we connected the high and low pressure mains together in a temporary way, with a small 2-inch mercurial governor between, to regulate the district pressure on Aberdour. On the inlet to the governor we had the pressure as delivered by the compressor; and it should be noted that the Crossgates district is also supplied from the same main through district governors. I would also draw attention to the fact that Aberdour is about 400 feet lower than Crossgates and Cowdenbeath—being on sea level.

The outlet pressure was set at 25-10ths; and this is never altered night or day. To operate the street-lamps, I simply add another weight to the little governor, allowing a trifle more pressure through for the time being. This system, however, required the constant running of the compressor night and day; and, being about 400 feet lower than the holder at Cowdenbeath, even a temporary low pressure supply was impossible. The completion of the gasholder altered things. The high-pressure main is now led direct into the gasholder, and on this main is fixed a cut-off inlet valve, which is operated by a back balance-weight from the holder itself—that is to say, when the holder is full up it engages and operates a weight which falls on the valve head, closing it tightly against the compressor. The holder therefore cannot get too full; and when it begins to fall, the valve opens and more gas passes in.

Possibly the most interesting part of the scheme is the arrangement whereby the compressor can be stopped at any time—for cleaning, repairing, or even to save steam—and still a supply be automatically maintained on the high-pressure main sufficient to supply the few consumers thereon in addition to the Crossgates district. This is accomplished by fixing at the holder a return valve, which is operated by a diaphragm governor connected to the high-pressure main. If the compressor is stopped, the pressure falls at once. This releases the return valve, which opens up and allows the gas in the holder to pass back the high-pressure or inlet main; and in this way the holder takes up the duties of the compressor for the time being. The holder gives 5½ inches of pressure; and this, added to the 400 feet altitude, gives quite sufficient pressure all along the line of the high-pressure main. One important point is that no one requires to be stationed at the holder—the whole arrangement being quite automatic.

DISCUSSION.

Mr. Waddell moved a vote of thanks to Mr. Darling for his interesting paper. He had shown an admirable way of getting over difficult matters. There was hardly any end to circumstances with which, if put to it, they might be able to cope. High-pressure lighting had very much widened their sphere of operations in this directon.

Mr. H. Rule (Kelty) said they would have appreciated the paper much more had it been read at Aberdour, where they could have seen the holder and the difficulties that had cropped up. He was astonished that Aberdour had remained so long without a gas supply. They had suffered very much at Kelty from the difficulty of deciding where the meters should be placed. A number of the miners' houses there had the meters in the front room; and when the Company had to put a cooker in, the whole house had to be disturbed, and a lot of piping had to be employed. He was pleased to hear that the outlet pressure at Aberdour was never altered night or day—a most desirable state of affairs. At Kelty they were very timid as to leakage, and about twelve o'clock at night they turned it down. This was done in 90 per cent. of places.

At the conclusion of the discussion, a vote of thanks was accorded to Mr. Darling.

The Social Side.

Later in the afternoon, the Gas Committee entertained the members at tea in the Royal Hotel, Dunfermline. This was followed by a musical programme given by members of the Association.

The Chairman (Mr. J. Scott) moved a vote of thanks to the Gas Committee for the splendid way in which they had entertained the members, and to Mr. Waddell for his kindness in showing them over the works, and for the time and trouble he had expended to make their visit a success.

Mr. Waddell, in acknowledgment, said he was one who had a very sanguine idea as to the good that could be done by such an Association as theirs, and he had no doubt that as time went on this would be more and more confirmed.

Mr. David Fulton (Helensburgh) conveyed a fraternal message from the Western branch of the Association. He said the turn-out that day had been very good, when they considered the circumstances of the present time and the difficulty members had in getting away from their works. He was much pleased with Mr. Darling's paper. He was sorry the war had prevented the joint visit of the two branches. This year Professor Smithells was to deliver the introductory lecture to the Western branch. They all knew of his eminence as a chemist; and they expected to derive great benefit from his lecture.

Meter Parts for Australia.—It is announced that the Commonwealth of Australia Department of Trade and Customs have issued a bye-law cancelling previous bye-laws and specifying "parts of gas-meters" which may be admitted to the Commonwealth. They are now subject, under the general tariff, to a 10 per cent. *ad valorem* duty; but under the British preferential tariff they are admitted free. As regards locks and brass unions, security must be given that these will be used only in the manufacture of gas-meters, and evidence of such use furnished to the collector within six months (or such further time as the collector may allow) after delivery by the Customs.

LEGAL INTELLIGENCE.

LEISTON PUBLIC LIGHTING CONTRACT.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Tuesday, Feb. 1.

(*Before Mr. Justice* Low.)

Leiston Gas Company, Limited v. Leiston-cum-Sizewell Urban District Council.

This action, which raised a question as to the liability of authorities in respect of public lighting contracts, having regard to the regulations under the Defence of the Realm Act, was heard on the 22nd ult. [*ante*, p. 211], when judgment was reserved. The Company claimed £157 15s. 9d. for services rendered to the Council under a contract entered into in 1911. The defendants denied liability, on the ground that the Company had not supplied gas during the period for which they claimed, in consequence of an order made by the military authorities.

Mr. Matthews, K.C., and Mr. Rayner Goddard were for the plaintiffs; Mr. Hawke, K.C., and Mr. Poyser, for the defendants.

Judgment.

His Lordship, in giving judgment to-day, said: In this action, the plaintiffs, the Gas Company, claimed from the Local Authority the sum of £157 15s. 9d., being three quarterly payments said to be due on March 31, June 30, and Sept. 30, 1915, under an agreement entered into between the parties, dated June 2, 1911. The agreement was for five years from Aug. 1, 1911, and to remain in force until determined by either party giving six calendar months' written notice expiring on July 31, 1916, or July 31 of any subsequent year. No notice to determine the agreement had been given. By clause 2 of the agreement, the plaintiffs undertook to provide by Aug. 11 columns, lanterns, and burners, and to maintain same; the whole of the plant remaining the property of the Company. This obligation was duly performed. By clause 4 it was provided that during the contract period plaintiffs were to supply gas, light, extinguish, clean, paint, and repair the lamps; and it was not alleged that this obligation had not been performed, with the exception that the supply of gas was stopped. By clause 10 it was provided that if the Company should fail to light any lamp, unless the failure was due to circumstances beyond their control, they were to pay penalties to the defendants. The defendants did not rely on this clause, and therefore he would express no opinion upon it. Under the powers of the Defence of the Realm Act, orders had been made which at first stopped the lighting of some of the lamps, and afterwards the whole of the lamps referred to in the agreement. From the 1st to the 26th of January, only 26 were lighted; but after Jan. 26 none of the lamps were lighted. In these circumstances, it was contended, on behalf of the defendants, that immediately the Order was made forbidding the lighting of the lamps, the agreement came to an end, and plaintiffs were entitled to remove the plant and defendants were absolved from making any further payments. In support of this proposition, several authorities had been cited.[*] He had first to consider what the contract was. It was not only a contract to furnish light, but for a given period the necessary plant; and it was impossible to distinguish how much was for the lamps and how much for the actual gas consumed. On a five years' contract, it was not improbable that the gas was the larger amount. He had next to consider whether the supply of gas in defendants' district had become unlawful within the meaning of the authorities relied upon. In times of emergency power was given to the Local Authority to suspend lighting; so that the provision as to lighting within the defendants' area became unlawful. What the Court in the cases cited had to consider was whether the state of things rendered the carrying out of the contract unlawful or impossible; but in the case he had to consider it was impossible from day to day, or from week to week, to tell whether it would be necessary to stop all, or some, of the lights. The plaintiffs might be ordered on the repeal, or relaxation, of the restriction to go on with the lighting, and to keep the plant in working order, and it was not material that the restriction had turned out to be of very considerable length. The contract was an executed contract; and it was impossible to divide the charge per lamp, and to say that so much was due for gas and so much for the lamps. He had come to the conclusion that, by the exercise of the power under the Defence Act by the defendants, the performance of the contract had not been rendered unlawful or impossible. In the course of the proceedings he had seen certain correspondence that had passed between the parties which had not been put in, and therefore it did not affect the legal position. From the letters he gathered that the plaintiffs had desired to come to some equitable arrangement by which the defendants should have credit for gas not consumed. This suggestion the defendants declined to accept or even consider. It seemed to him a pity they did not do so, and it would surely have been a wise and fair thing in this case and other cases of the sort (should any arise) for local authorities, rather than spend the ratepayers' money in litigation, to come to some such arrangement as was suggested by the plaintiffs. Perhaps it would be better still if Parliament could find time to insert in one of the emergency Statutes a clause providing for equitable adjustment of such a dispute as this, and so prevent local authorities being tempted to incur the expense of litigation in circumstances similar to those in this case. With reference to the defendants' contention that the contract should be treated as suspended while the Emergency Act was in force, he thought there was no ground for doing so. Judgment must therefore be entered for plaintiffs for the amount claimed, with costs.

Mr. Hawke asked for a stay of execution.

Mr. Matthews said plaintiffs claimed interest on the amount due; but if the case was not carried further, they would waive this.

His Lordship said he had not calculated the interest.

Mr. Matthews: Then we will say no more about it.

A stay of execution was granted, upon defendants entering an appeal within fourteen days, the costs to be paid on the undertaking of the solicitors to return same in the event of the appeal being successful.

GAS MANAGER'S WIDOW CLAIMS COMPENSATION.

Sequel to the Death of Mr. E. H. Millard, at Cowes.

His Honour Judge Percy Gyr, at the Isle of Wight County Court last Wednesday, had before him an application under the Workmen's Compensation Act by Mrs. Frances Mary Millard, widow of the late Manager of the Cowes Gas-Works, for compensation for the death of her husband under circumstances recorded in the "Journal" for Oct. 5 last [p. 47]. The respondents were the Cowes Urban District Council, who are the owners of the gas-works.

Mr. Duncan appeared for the applicant, and Mr. Shakespeare for the respondents.

Mr. Duncan said that the applicant's husband, the late Edward Henry Millard, was Manager and Engineer of the Cowes Gas-Works. On Sept. 27 he met his death, which was caused by *angina pectoris*, accelerated by gas poisoning. There were three dependants in addition to the widow—two girls, aged 11 and 5, and a lad at sea, for whom apprenticeship indentures were being paid for two years. The respondents said that deceased was not a workman to whom the Act applied, and that as he was Manager and Engineer of the gas-works earning more than £250 a year, applicant must show that he was a manual labourer as well. He should prove that the late Mr. Millard was engaged on manual labour by reason of strike troubles and shortage of labour, and still more since the outbreak of war, when he had been shorthanded. He had had to take off his coat and act as stoker at night for hours at a time. Moreover, he was actually engaged as a manual labourer when his death took place, as he was in the act of installing a governor on the retorts when the gas fumes became so bad that he was overpowered, with fatal results. The work on which he was engaged involved the cutting of a gas-pipe.

His Honour: How came it that he was allowed to cut a pipe while gas was passing through it?

Mr. Duncan: He was Manager and Engineer; and he himself decided to take the risk rather than keep the town of Cowes in darkness for 24 hours. He risked his own life in doing it, and lost his life. He did not anticipate the gas fumes would have such an effect upon him.

His Honour: He thought he could stand the gas which came out?

Mr. Duncan: Yes, as he might have done if he had not been suffering from *angina pectoris*. Another man was even more badly affected at the time; but, having a strong heart, he did not die.

Mr. Shakespeare: This governor had nothing to do with the lighting.

Mr. Duncan said no doubt death was accelerated by gas poisoning. Numerous cases under the Workmen's Compensation Act were recorded of accidents in connection with the cutting of gas-pipes.

His Honour asked if an appeal was likely to follow in the case.

Mr. Shakespeare: Certainly.

His Honour thereupon suggested that it would save the time of the parties, and of the Court, as well as probably reduce the costs, if both sides agreed to a shorthand note being taken under his (the Judge's) supervision.

Counsel then conferred, and,

Mr. Shakespeare announced that they had settled the case, subject to his Honour's approval. The terms of settlement were: £25 for the widow, and £25 for costs. In his (Counsel's) view, it would have been impossible for his Honour to have held that Mr. Millard was a workman who came under the Act, because he received a salary of more than £250 a year. In fact, he was employed by the respondents under a written agreement by which he was Manager of the works, and was in the position to take pupils.

His Honour: It does not come within the definition of the Act.

Mr. Shakespeare said the second ground upon which he relied was that his Honour could not have found that there was any evidence of acceleration of death at all. However, he felt that, whatever the result of these proceedings, whether they won or lost, the respondents would have to pay a considerable sum of money; and, in these circumstances, he had advised his clients that it would, perhaps, be in their interests, pecuniarily, if they paid the £50, as now proposed, to cover everything.

Mr. Duncan said he quite recognized the difficulty of proving that Mr. Millard was engaged in manual labour, and also other difficulties in the case.

Mr. Shakespeare said that the form of his Honour's judgment would be "award by consent, the respondents denying liability, for £50—£25 for the widow, and £25 for costs."

Judgment accordingly.

A Curious Workmen's Compensation Claim.

In the Bow County Court, on Jan. 31, before his Honour Judge Graham, K.C., an application was made under the Workmen's Compensation Act. The applicant was Mr. John Chamberlin, one of the Ilford Board of Guardians, on behalf of Frances Kate Huntley and her eight-year old son John; the respondents being the Gas Light and Coke Company. The amount claimed was £300. Mr. Bickmore appeared as Counsel for the applicant, and Mr. Robinson for the respondents. Counsel said the facts were rather remarkable. The man died of injuries sustained at the Beckton Gas-Works—liability for which was not denied—at which time he was paying for the upkeep of his wife in the lunatic asylum at Goodmayes. From time to time she sufficiently recovered to come out, but always had to go back. The boy of eight died one month after the father; and a peculiar legal situation therefore arose. The widow—being a lunatic—was chargeable to the Guardians; and Mr. Chamberlin had been deputed to watch the interests of the parties concerned. The point was as to the boy. Was he entitled to the full £300, as he had lived longer than his father, or only a small sum, and, anyway, how was the money to be apportioned? Then, again, who was to have charge of the money, whatever was awarded—the Court or the Guardians? Mr. Bickmore said he thought the difficulty could be got over by the Court taking charge. The deceased was a boiler maker, working as a plater, and was moving a chain on an overhead track when he fell into a hopper, receiving such serious injuries that he died almost immediately. Judge Graham ordered the £300 to be paid into Court, but said that for the time being he did not know what would become of it.

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[*] These were: Esposito *v.* Bowden 7 E. and B. 764, Baily *v.* De Crespigny L.R 4 Q.B. Cas. 180, Krell *v.* Henry 1903 2 K.B. 740, Geipel *v.* Smith L.R. 7 Q.B. Cas. 404.

Sewers Blocked by Pitch at Manchester.

On Monday of last week, at the Manchester County Court, before his Honour Judge Mellor, K.C., an action for damages was brought by a licensed victualler named Hall, of the Victoria Inn, Clayton, against the Manchester Corporation, and the Manchester and Sheffield Tar-Works Company, Limited, also of Clayton, for damages alleged to have been caused through the flooding of his cellars by sewer water in August. The case against the Company was that they had failed to provide means to prevent the water backing-up through the connecting drain into the plaintiff's cellars; and against the other defendants it was alleged that they had allowed tar or pitch from their works to escape into the sewer and so cause an obstruction. Evidence was given by the plaintiff and his wife to the effect that on one particular occasion the water in the cellar was about waist high. Liability was admitted on the part of the Tar-Works Company; but Counsel for them argued that his clients should not be saddled with the costs of the Corporation, in addition to their own. He did not admit that the Tar-Works Company alone were liable. For the Corporation, it was submitted that there was no case against them; and reference was made to a letter of the Tar-Works Company expressing regret that the action of their own servants had resulted in the pitch blocking the sewers. His Honour dismissed the Corporation from the action, and gave judgment for the plaintiff against the Tar-Works Company for £17. He ordered them to pay the costs of all parties.

"Dutch" Gas-Mantles Forfeited.

In October last ["Journal," Vol. CXXXII., p. 652], some cases of incandescent gas-mantles, consigned by a Dutch firm to an agent in Edinburgh (C. I. Michaelson) were seized by the Customs Authorities at Leith, in respect that the goods were imported into the United Kingdom contrary to the Customs (War Powers) Act, 1915. At the commencement of proceedings in the Edinburgh Sheriff Court in December, the Works Manager of the Welsbach Light Company expressed the opinion that the sample mantle produced was undoubtedly of German make. The case was adjourned to the 17th ult., and again to the 31st, for the purpose of getting two witnesses from Holland to give evidence on behalf of the defendant Michaelson. On the case being called on the latter date, defendant's Counsel stated that, despite letters and telegrams, he had not yet been able to produce the witnesses; and he asked for another adjournment. The Sheriff refused the application, and granted the petition for forfeiture of the mantles. It is understood that an appeal is to be lodged.

Breach of a Sulphate of Ammonia Contract.

Last Tuesday, Mr. Justice Bailhache delivered his reserved judgment in the King's Bench Commercial Court in the case in which Messrs. Mitsui and Co., Limited, of Lime Street, sued Messrs. Watts, Watts, and Co., Limited, of London and Cardiff, to recover damages for breach of a charter party of June 5, 1914, in regard to the carriage by steamer to Japan of a cargo of 3500 tons of sulphate of ammonia. The plaintiffs contracted with the defendants for them to send a steamer to Mariopol, in the Sea of Azov, in September, 1914, and there load the cargo and take it to Japan. Defendants failed to send the steamer, pleading the war as justification. Plaintiffs bought the ammonia from Evence Coppée Company; and the latter's claim for damage for non-acceptance by the plaintiffs was settled for £4500. Mr. Justice Bailhache did not think the defendants could plead the closing of the Dardanelles as an excuse for their breach of contract. He thought the plaintiffs were entitled to recover as damages against the defendants the sum of £3800 profit that they would have made if the goods had been carried to their destination; but the £4500 that they had paid to their sellers as compensation was too remote as damages against the defendants. Judgment was entered for the plaintiffs for £3800 and costs.

Cannock and Hednesford Gas Company.—The nineteenth annual report of the Cannock, Hednesford, and District Gas Company shows total receipts for the past year amounting to £21,454, and a total expenditure of £16,738, leaving a balance to the credit of the profit and loss account of £4716. A dividend of 7 per cent. is recommended, leaving a balance to be carried forward of £935. The expenses connected with the manufacture of gas amounted to £9885; for the distribution, £2169; and lighting and repairs of public lamps cost £501. The sales of gas, including £963 4s. 6d. for public lighting and contracts, realized £16,223. Residual products gave an income of £3932. The total quantity of gas sold was 90,428,000 cubic feet.

MISCELLANEOUS NEWS.

THE GAS LIGHT AND COKE COMPANY.

The Half-Yearly Ordinary General Meeting of the Proprietors was held last Friday at the Chief Office, Horseferry Road, Westminster—Sir Corbet Woodall, M.Inst.C.E. (the Governor), in the chair.

The Secretary (Mr. Henry Rayner) read the notice convening the meeting.

Death of Sir Hugh Owen.

The Governor: Ladies and Gentlemen, It will be noticed that a chair on this side of the table is vacant this morning. The death of Sir Hugh Owen has been a great loss to the Company, and a very heavy blow to his colleagues. Sir Hugh was a man of great wisdom and knowledge; and he was, at the same time, as loyal and as kindly a colleague as man ever met with. He had opinions of his own, but was always considerate for those of others. It is no exaggeration to say that all his colleagues loved him.

The Governor's Speech.

The Governor: Ladies and Gentlemen, as usual I presume we may take the report and accounts as read. In moving their adoption, I have not very much to say. For the fourth time we meet under the dark cloud of war, and practically every item of our accounts is affected by that sad fact. In August last, I explained that, in order to make our income balance the expenditure, it had been found necessary to raise the price of gas a second time (from 2s. 8d. to 3s. per 1000 cubic feet) from the end of March, 1915, and this had accordingly been done. The advantage of the higher rental attached to only one-half—and that the lighter one—of the June half year; but so also the full burden of heavier costs did not apply, by reason of delays in delivery of coal and other necessaries. The result was that the desired balance was secured, with a margin to the Company of a little over £50,000. In the half year under review, the proportion of coal and oil purchased at higher prices has been considerably greater, and the expenses consequently heavier. This notwithstanding, the higher price of gas having operated throughout the whole period, and for other reasons which I will explain shortly, we have been able to pay our way, provide the statutory dividend, and make a further small addition to the balance carried forward. Owing to the smallness of our working capital, which is but little more than £500,000, the balance on net revenue is of great value. Before we can call up more capital we shall apply to Parliament for an alteration in the terms upon which we may issue the £750,000 of 3 per cent. debenture stock granted to us in 1903.

THE CARRY-FORWARD.

I have recently received an unsigned letter from a shareholder, in which he politely calls attention to the large amount of our carry-forward, and asks whether it is not more than is necessary, and might not be applied to making what would be a welcome addition to the dividend. Many shareholders seem to find it difficult to appreciate the fact that our dividend is governed, not by the amount of profit earned, but by the price at which the gas is sold. It would tend to satisfy any such shareholder if he would study the accounts of the Company for the last three years. From these he would see that the amount to carry forward has been reduced in that period by about £250,000 sterling. Had it not been for the increase in the price of gas, we should now have entirely wiped out that valuable fund. We have no intention at present of making such an application to Parliament as I have said is necessary. The alternative is to keep a substantial balance to the credit of our net revenue account, and at the same time to limit works expenditure, if possible, so that it does not exceed the sum allowed for depreciation. The capital spent last half year was £71,898, while the depreciation was £128,316; the result being an improvement of £56,418 in the floating balance.

THE REVENUE ACCOUNT.

A few figures from the revenue account are interesting. As compared with the corresponding half of 1914, coal cost more by 5s. 3d. per ton, or £227,739 Of this increase, the amount due to the higher price was £214,481; the balance being due to the larger quantity. Oil also was dearer by £14,847; coke and breeze for carburetted water gas cost £14,765 more—the total for raw materials being an excess of £257,351. Against this, residual products improved by £202,017; leaving a net excess cost of £55,334. All the residual products yielded satisfactory prices. Among those are a number of articles not previously made by us, the provision for which has involved considerable alterations in the appearance of the Beckton Chemical Works. The new manufactures have been partly undertaken at the request of the Government for war purposes; and others in aid of the dyeing industries. I hope the word will not be misunderstood. The sooner we cease producing the former for the purposes to which they are now applied, the more pleased we shall be; but we hope to retain the latter indefinitely. We have started new industries which we believe will be a source of profit to us. These new and urgent demands have put a severe strain upon Mr. Adam, the Manager of the Products Works; and I am glad to acknowledge the ability and devotion with which he has given himself to the work.

REPAIRS AND MAINTENANCE.

Under the heading of "Repair and Maintenance of Works and Plant" there is a larger amount by £50,960. This includes £15,000 for a dismantled gasholder at Bethnal Green; the balance being chiefly for advanced wages, and the higher cost of fuel for boilers and sundry purposes. Upon the question of rates and taxes, the past year was the quinquennial period when the assessments of the London boroughs are revised. The whole of those in which the Company are interested are now concluded, and the result, I am glad to say, shows material reduction in the amount. The war wage and bonus on salaries totalled in the half year to £67,252. This sum is divided under various headings on the accounts.

INCREASED OUTPUT AND REDUCED UNACCOUNTED-FOR GAS.

The fact that there has been an increase of 1½ per cent. in the quantity of gas sent out is, to my mind, very satisfactory, having regard to the continued reduction of the public lamps and outside shop lighting, as well as the very material shortening of the hours of opening of licensed houses. The increase in the price of gas has also certainly tended to diminish the consumption. The inference from this is that, had it not been for the adverse conditions created by the war, the increase in the Company's business would have been large. Another satisfactory circumstance is that the percentage of unaccounted-for gas has been reduced. The proportion of carburetted water gas made in the half year was less by reason of the higher price of oil delivered to us. This is owing chiefly to increased cost of conveyance from America to England. Consequently upon this, the quantity of coal carbonized has been greater, and that of residuals produced necessarily larger. This has been a double advantage. It has enabled us to supply the Government with a larger quantity of materials of great value to the War Departments, and also, by diminishing the consumption of coke used in manufacture, to maintain the supply of domestic and industrial fuel.

A TRIBUTE TO THE "WORKING CLASS."

I have already stated that the amount paid for manufactory wear and tear wages has shown a very large increase. I am bound to say that for my part I do not grudge this. There can be no doubt as to the great rise in the cost of the means of living; and the margin at the disposal of the working class as a whole was not sufficient to cover this. I believe that those whom we entitle the "working class" are as keen for the success of our arms in the war as any other class; and I trust that they will learn more fully from week to week how largely and comparatively easily they can contribute their share to the country's success in the great struggle in which it is engaged. We note that when engaged upon the actual manufacture of munitions or other materials to be directly employed by our soldiers, there is a keenness greater than is in evidence generally when they are occupied in their ordinary duties day by day. What we wish them to realize is that by putting into their daily work all the enthusiasm and vigour of which they are capable, they will be serving their country's cause as truly as those who are fighting at the front. The net revenue account shows that the Directors have written-down the book-value of their investments by £24,897. This is not quite to the market price; but it is a long step towards it, and we think it is sufficient for the present. A sum of £10,000 has been carried to the special purposes fund. Although the Directors have taken out policies against air risk for certain parts of the works, they do not think it advisable, owing to the heavy cost it would involve, to insure the whole of their property. They therefore prefer to strengthen the special purposes fund, which, you will recollect, was previously called the insurance fund. This stands at something over £300,000. Whether the Directors will reconsider the question of largely increasing the insurance, owing to recent developments, is a matter for consideration.

TRADING RESULTS FOR THE HALF YEAR.

The result of our trading for the half year is a balance of £604,314, as compared with £449,510 for the same period of 1914. After charging against this the items set out in the net revenue account—interest, dividend on special funds, &c.—and adding the balance brought from the last account, we have available for dividend the sum of £794,485. Out of this, the Directors recommend the payment of dividend at the rate of £4 4s. per cent. per annum; and if this is approved, they will carry forward £446,615, as against £384,538 a year ago. Looking at all the circumstances of the half year, I think the result is a good one; and I hope the current period may prove no less satisfactory.

COAL AND FREIGHTS.

The anxieties and troubles we have gone through have been many, and those in front of us are not likely to prove less. We can bear the inevitable with patience; but I resent some which appear to me unnecessary. A year ago I drew attention to the grave burden placed on users of coal in London and elsewhere by the heavy rates charged for shipping freights from the Tyne and Yorkshire ports to London. I pointed out that the large numbers of collier ships commandeered by the Government at the outbreak of war were at that time earning a rate of about 3s. per ton from the Tyne, and that the price paid for them by the Government equalled about 4s. per ton—yielding to the owners a very good profit, with which I believe they were fully satisfied. The number of ships withdrawn was so great that there were not enough remaining to bring to London the coal required; and upon a petition of users, certain enemy ships interned in our ports were released and placed at the disposal of the trade. It will be noticed that it was not the ships commandeered by the Admiralty which were returned (ships built for the trade, and which might be said to know their way to and fro almost like bus horses on their routes), but the strange enemy ships—some of them sadly unsuitable for the purpose. There was then a serious lack of ships; and competition being removed, the freights charged were ruinously high. These inflated freights the Government called "market rates," and asked owners, who were receiving from them 4s. per ton for good collier ships, to pay as high as 14s. 6d. per ton for the make-shift and inferior enemy ones. Thus early did Government come under the pernicious and abominable influence of the idea of "war profits." Under the operation of the London Coal Supplies Advisory Committee, who meet in these offices and apportion the interned boats among the representatives of the Public Utility Bodies, and of which our General Manager is Chairman, the freights charged have been less than those commonly demanded; but they are high enough to be greatly burdensome, and to furnish a welcome encouragement to those who insist on the highest terms that can be exacted. At present the position is peculiarly onerous and perplexing. As the shareholders are aware, we are engaged in the most strenuous efforts to make munitions and to produce materials for the manufacture of high explosives. We receive from the Technical Departments of the State urgent requests to furnish the uttermost pound obtainable, and, I am glad to say, also cordial acknowledgment of what we are doing. As the products so valuable to the fighting forces are all wasted where coal is burnt in open grates, and can only be obtained when coal is distilled in closed retorts, citizens are advised in Great Britain, in the countries of our Allies, and in those of our enemies, to refrain from burning the raw coal to destruction, and to use either gas or coke instead. If more gas is to be consumed, largely for these patriotic reasons, its price must be kept as low as possible; yet the opposite of this is the effect of the policy of high freights adopted by another Department of the Government. If the Company are compelled to pay 5s. per ton more for delivery of their coal than is necessary, the extra burden will amount to about £400,000 per annum; and that, passed on in a considerable part to the consumers in the price of gas, must greatly reduce the succour we are able to render to the War Office and Admiralty. It is difficult to conceive of divided interests over such a matter; and yet there they are—clearly operating. Also, since the war began, nothing has been more humiliating than the struggle so generally evident in certain quarters to make private profit out of the tragical circumstances in which the country is plunged. The decision of the Chancellor of the Exchequer to take for the benefit of public funds half of the plunder which is obtained, has given countenance and encouragement to the practice, and is, to my mind, deplorable. If such profits are to be allowed, surely the whole should go to the State. I am told (but cannot vouch for the fact) that there are British ships trading to-day between foreign ports, and never coming to England lest the owners should be called upon to contribute their share to her needs. Can any contempt be too deep, or censure too outspoken, for such traders on their country's hardships? I am glad to know that at last the Government has appointed a Committee to take control of all the nation's ships, and see that they are fully used in the most urgent services, and that reasonable freights are charged for them. Let us hope that this Committee will speedily get to work, and make its power felt in the right quarters.

THE COMPANY'S SHIPS AND RUNNING COSTS.

To meet in some measure the very heavy burden of freights, we have, as you are aware, purchased certain ships. One—an excellent one—the "Fulgens," built especially for us, was torpedoed on Aug. 1 last; a second, the "Ignis," went the same way—leaving us with three of our own, one hired by the year, and a fifth on the stocks, or I hope it is. Our own ships cost for running 3s. 2d. to 4s. 11d. per ton during the half year just closed. This is an instructive comment on the 10s. to 14s. rates now being paid to the Government and the high freights demanded on the market for outside tonnage. The two ships lost saved all their crews, and were fully insured as to the ships and the cargoes which they carried. Other ships have been bought to replace them. We have now eight ships, either of our own or chartered for us by the year.

COAL PRICE LIMITATION.

Last year, at the instance of the public utility services, especially those engaged in electricity and gas supply, an Act of Parliament was passed limiting the amount by which the pre-war price of coal should be increased. This was approved by a Committee upon which coalowners were duly represented. I am sorry to say, however, that the Act was no sooner passed than ingenious minds were directed to making it as little operative as possible, and to swell further than the Act contemplated the profits accruing to owners and agents.

VALUE OF CO-PARTNERSHIP.

Where costs of manufacture are increased, the prices charged will, where possible, be raised also; and this is but reasonable. Our industry is practically the only one in which a rise of price must be accompanied by a decrease in divided profits. In most others the increase of profits is secured by an increase of price. The system of co-partnership introduced into the gas industry by the late Sir George Livesey ensures that if, by any means (especially by greater energy and enterprise) the price can be lowered to the public benefit, the proprietor reaps advantage and the workman co-partner gets an increased bonus, in addition to the satisfaction of knowing that he is doing a man's work for his country. The appreciation of this is, I believe, growing among the Company's staff as a whole. I wish with all my heart that a similar system were adopted by other great public service undertakings, and regret that, while such an arrangement for distributing extra profits remains peculiar to statutory gas companies, it must remain unknown to, and consequently unappreciated by, what passes for popular opinion.

Adoption of the Report and Accounts.

The Governor: I have pleasure in moving:

> "That this meeting do agree with, and confirm, the report of the Directors 'and the Auditors' report and statement of the accounts of the Company as transmitted to the proprietors on the 27th ult."

Before putting the resolution to the meeting, I shall be happy to hear any remarks which proprietors may wish to make, and to endeavour to answer any questions they may ask.

The Deputy-Governor (Mr. John Miles): I beg to second the resolution.

Proprietors' Appreciation.

Mr. W. A. Hounsom thought the first word from his side of the table should be one of sympathetic endorsement of the remarks which had fallen from the Governor on the decease of Sir Hugh Owen. The shareholders had lost an able representative on the Board, and the Directors had lost a capable, conscientious, and courteous colleague. He thought the shareholders often lost something by not realizing what the meeting was. The report stated it was the "half-yearly ordinary general meeting;" but it was the meeting of the Company. It was true the shareholders were present only in a small number—and he had often expressed a wish that more would attend—but even the small number present were representatives of the Company. There was another matter they must remember that, after all, the Directors, exalted as their position was, were really part and parcel of the Company—being the representatives to carry on the business. The Company was a democratic affair, and proprietors were entitled to come to the meetings and ask any questions more or less wise, and to criticize in a manner more or less relevant or irrelevant. He said this because then he thought he should get at the real basis of sympathy between those present, treating the Directors and proprietors as a whole. Having said this, he was entitled to say what the Governor, with his modesty, would not say—that the result of the half-year's working had been remarkable. The fact that there was a small balance to the good was in itself a high tribute, not only to the Board but to all the officers of the Company in the adjustment of the items of expenditure and revenue so as to bring about such a happy result. They might look still farther, and go to capital account, and congratulate themselves as a whole on the fact that the balance had gone up £112,000 in the year. It was extremely difficult where the figures were so large to come to real ultimate conclusions; but all these facts were facts in their favour. He confessed that a short time ago he looked forward to the possibility of a necessary indication of a rise in the price of gas, and he rejoiced that to-day there was not a whisper of the point. He wished to go one step farther, and say from his side of the table there should go forth a deep expression of sympathy to those who had borne the heat and burden of the day. Some 2600 men in the pink of life had gone from the Company to the front; and the Board and the staff had had to meet the demands of the public and of the Government with a depleted staff. He noticed from the "Co-Partnership Magazine" that the Board had recently introduced a new element into the staff—viz., female labour. All these things the shareholders ought to take into account when they paid a tribute to the work of the Board, the staff, and the workmen, as he desired to do most heartily. In these times of stress, they ought to think over the work that had been done in order to strengthen the bond of sympathy between themselves and the workmen. He looked forward, not without some anxiety, but with great hope, to the future. The true prospective of the strenuous times through which they were passing would never be available to many in the room; but when that vision came, with the lofty ideals which prevailed in the country, the verdict surely would be that they had done their best, and that that best had resulted in benefit to all concerned.

Mr. J. H. Nelson asked what was the meaning of the special purposes fund. They had been told it was chiefly an insurance fund; but he rather forgot what were the other purposes covered.

The Governor: The insurance fund was definitely limited to certain purposes, and the special purposes fund was broadened in ways that were explained to the Houses of Parliament and are embodied in the Act of Parliament. We are able to use it for the removal of works from one site to another, for the reconstruction of works of a special character, and so on. Now let me thank Mr. Hounsom for the cheering words he has addressed to us, and for the appreciation, which he never lacks, of the stress and strain which come at times on the Board, the staff, and the workers of the Company. The work of the past six months has been of a character which has necessitated our General Manager (Mr. Milne Watson) taking a rest for a time, and has had its influence on many of us to a serious degree. With regard to the men who have gone to the front, we are very proud indeed of them, and we expressed it in a message which we sent to all of them at Christmas, and which has been acknowledged by many of them with high appreciation. We have in our employ, taking the place of some of the men, about 420 girls and women, who are doing their work most admirably. This has involved a considerable amount of labour of one sort and another, adapting the premises to the convenience and use of the girls—one room has been prepared as a sitting-room for them. We have not neglected to take what care we can of them.

The resolution was put and carried unanimously.

The Dividend.

The Governor: I will ask the Secretary to read the minute with regard to the dividend.

The Secretary then read from the Directors' minutes the following:

> Resolved: That it be recommended to the half-yearly ordinary general meeting of proprietors to be held on the 4th prox.:
>
> (1) That the sum of £5000 be set aside out of the divisible profits of the Company for the half year ending on the 31st day of December last towards the redemption fund, in accordance with the provisions of the Company's Act of 1903.
>
> (2) That a dividend as follows for such half year be declared—viz.:
>
> On the 4 per cent. consolidated preference stock at the rate of £4 per cent. per annum;
>
> On the 3½ per cent. maximum stock at the rate of £3 10s. per cent. per annum;
>
> On the ordinary stock at the rate of £4 4s. per cent. per annum;
>
> subject to deduction of income-tax.

The Governor: I beg leave to move the adoption of these recommendations.

The Deputy-Governor seconded the motion, which was put and carried unanimously.

Re-Election of Directors and Auditors.

The Governor: I have now much pleasure in proposing the re-election of Mr. Herbert Jameson Waterlow as a Director of the Company. I was very hopeful of the services which Mr. Waterlow would render to us when he joined the Board, and that hope has been more than fulfilled.

The Deputy-Governor: I have much pleasure in seconding the motion. I happen to have known Mr. Waterlow for several years, and I am sure what the Governor has said with regard to him is perfectly accurate.

The resolution was unanimously carried.

Mr. Waterlow expressed thanks for his re-election.

The Deputy-Governor: I have now the pleasure of proposing the re-election of Mr. Henry Woodall. He has an advantage over all the other Directors in one particular, and always will have—he is much younger. I can assure you, as far as his capacity is concerned—and I have the pleasure of meeting him on a Committee—he is a most capable, industrious, and intelligent Director.

Mr. Waterlow: I have much pleasure in seconding the motion. I can only say he is a very able son of his brilliant father.

The resolution was passed unanimously.

Mr. Henry Woodall thanked the shareholders for his re-election.

On the motion of Mr. A. Bevis, seconded by Mr. J. Hatchwell, Mr. John Allen Stoneham and Mr. Percy Howard Ashworth were re-elected Auditors.

The Governor: That completes the business of the day, and I thank you for your attendance.

Votes of Thanks.

Mr. F. G. Pilley said the Company had completed a year of working under the shadow of a great war, which war had exhausted the normal condition of things. The Government had felt compelled to impose restrictions and regulations upon trade, and, in addition, they had made very heavy demands upon various concerns, especially the gas companies. These restrictions had meant great expense in the successful working of a huge concern like theirs, and a heavy demand upon the resources of the Company, both active and latent. What they had heard that day fully justified him in saying that, in spite of these restrictions, the Company had come out very well indeed. He thought he should also be right in saying that the demands made upon the Company had been fully met, whether by men for active fighting life or by things asked for to enable the war to be brought to a successful conclusion. How had the result of the last six months been brought about? Simply by the fact that the Company were well organized and able to adapt themselves to new conditions and the demands made upon them; and also to the fact that they had an excellent Governor, a capable Board, backed up by an able staff and able workmen. He had much pleasure in moving that the meeting desired to place on record the deep appreciation of the work of the Governor, the Board, the staff, and the workmen of the Company.

Mr. Reginald J. N. Neville, M.P., in seconding the motion, associated himself with everything said by the mover of the resolution. With many men at the front it had been extremely difficult to carry on the work; and he hoped that the proprietors would pass a resolution thanking the gallant men who were fighting in the trenches. The Gas Light and Coke Company, which was the premier gas company in the world, was the one which should take the lead in this matter. He should like to have heard how many of their men had received distinctions and commissions, as there must be many who ought not only to be honoured by the proprietors but throughout the whole of England.

The resolution was carried unanimously.

Reply by the Governor.

The Governor: On behalf of my colleagues and myself, as well as the officers of the Company, I thank you for the very cordial vote that you have recorded. With regard to the men at the front, we have, as is stated in the report, about 2600 there. Out of this number I am not able to say how many have received distinctions; but I think at least twenty have received commissions, and many have been specially mentioned. I have included in my response the officers (to whom I desire to express also my own personal and cordial thanks); and I hope somebody will propose a resolution thanking those gallant fellows who are doing such valuable work at the front.

The Staff and the War.

Mr. Neville said he should have much pleasure in proposing that the hearty thanks of the proprietors be given to all those who had represented the Company at the front, including the naval and military units, and also the munition workers.

Mr. W. Mann seconded the motion.

The Rt. Hon. Sir Daniel F. Goddard, M.P., in supporting the motion, said he thought it most desirable that such a resolution should be passed at the present time.

The resolution was put, and carried unanimously.

The proceedings then terminated.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

Approval by the Proprietors of the Bill in Parliament.

An Extraordinary Meeting of the Proprietors of the Association was held last Wednesday, at the Cannon Street Hotel, E.C.—Sir Charles J. Jessel, Bart., in the chair—for the purpose of considering, and, if thought fit, approving of, the Bill now before Parliament, intituled "A Bill to Remove Doubts as to the Power of the Imperial Continental Gas Association to Sell or Dispose of Portions of their Undertaking, to Confer Various Powers upon the Association, and for Other Purposes."

The Secretary (Mr. Robert W. Wilson) read the notice convening the meeting.

The Chairman said the resolution he had to move was couched in the following terms:

> Resolved that a Bill to remove doubts as to the power of the Imperial Continental Gas Association to sell or dispose of portions of their undertaking, to confer various powers upon the Association, and for other purposes (which has this day been submitted to such of the Proprietors of the Association as were present in person or by proxy at a duly convened extraordinary meeting) be hereby approved, subject to such alteration as may be made in the Bill by Parliament, and approved of by the Directors.

Proceeding, he said the primary cause of the application to Parliament for a new Act was the action of the Board in proposing, and of the proprietors in approving, the distribution of dividends at the meetings of November, 1914, and of May, 1915, without a scheme of profit appropriation as provided by section 120 of the Companies Clauses Consolidation Act, 1845. Going through the Bill, sections 1 and 2 merely referred to the title and the incorporation of the Companies Clauses Acts. Section 3 he would defer dealing with for a moment. Section 4 was the one proposing the confirmation of the distribution of funds as proposed and approved at the meetings referred to. At the last meetings of the proprietors, he fully explained that a technical breach of the law was made, and that they would be obliged to ask Parliament to condone this. This breach of the law was bridged-over by section 4 of the Bill for which approval was now asked. Then when their present powers were under searching examination by their legal advisers, which examination arose from having to submit to

Parliament the question of the technically illegal payment, they were told that certain of their powers were somewhat vague and insufficient. The powers referred to related to the sale of any of their undertakings, and participation with others in similar undertakings. The section principally in question was section 4 of their Act of 1870, which had hitherto seemed sufficient for all their operations in respect of these matters. He might say that, with the approval of the proprietors, the Directors had, since that Act was passed, sold several of the undertakings of the Association. He might instance Cologne, Bordeaux, Amsterdam, and Vienna; and they had also since then acquired large controlling interests in other undertakings—such as the Nancy Gas Company, the Wazemmes Gas Company, and the Compagnie Continentale du Gaz. All such transactions had been duly reported to, and approved of by, the proprietors in general meeting. Now their legal advisers considered that the words of section 4 of the Act of 1870 should be more freely defined, in respect of gas-works, mains, and the business conducted from them, and that amendment should be made which would sufficiently cover the holding of shares in any undertaking similar to their own. It was therefore proposed to make good, by section 3 of the Bill, any deficiency or ambiguity in the powers under which they had acted for forty odd years. [The Chairman read the text of the new clause.] He did not think he need trouble the proprietors with sections 5, 6, 7, and 8. They referred to capital stock and debenture stock—conferring no fresh powers, but modernizing and confirming in more detail those possessed, particularly in regard to redeeming "the whole or any part of such debenture stock, either by paying off the same at the price of £105 for every £100 of such debenture stock on giving not less than six months' notice in writing to the respective holders of debenture stock proposed to be redeemed of their intention to effect such redemption, or by issuing to any holder of such debenture stock, subject to his consent, other debenture stock in substitution therefor." Section 9 made it incumbent upon the Association not to reduce the nominal capital, unless simultaneously with such reduction they redeemed any then outstanding debenture stock to a nominal amount equal to one-fourth part of the nominal amount by which the capital of the Association was reduced. This was quite simple. It meant that, if they paid off £100 of ordinary stock, they must at the same time pay off £25 of debenture stock. Sections 10, 11, and 12 provided for the holding of one general meeting a year, for the payment of an interim dividend, and for the closing of the transfer books preparatory to the declaration of an interim dividend. Sections 13, 14, and 15 dealt with the number of the Directors and their qualification. The present Acts fixed the number of the Directors at ten; but it was now proposed to seek power, while retaining the number of ten as the maximum, to enable the number to be varied to a minimum of five. It would have been economical only the other day (in view of these war times), when they had a much regretted vacancy to fill up, if the Directors had been enabled not to deal with it. But they were bound by statute to fill up the position, and keep the number at ten, which might or might not be advisable under certain circumstances. Then, again, the qualification of the Directors was now £2500 of capital stock. This qualification with the present capital was maintained exactly as it was; but it was provided in the Bill for the qualification to be reduced by £500 for every million of capital which might be paid off. Section 15 contained provisions as to the use of the seal of the Association; and section 16 provided for the payment of the costs of the Act.

There was a little more or less conversational discussion mostly on questions of phraseology in the clauses. Mr. Wilfred C. Rundle, Mr. E. P. Vacher, Sir John Runtz, and Mr. E. T. A. Phillips took part, and replies were made by the Chairman and the Solicitor (Mr. Charles Wigan). The tenor of the discussion will be gathered by an indication of the replies made.

The Chairman said he thought that so long as the Association were authorized by English statutes to deal with a foreign body, that was all that was required; and the terms used in the Act "corporation, company, association, body, or person," were comprehensive enough.

The Solicitor also considered that section 3 as drafted covered everything. In his view, if they began to particularize too much, it would only lead to confusion.

The Chairman (replying to Sir John Runtz, who thought it a mistake that there should only be one meeting a year instead of two) said the Association were only putting themselves in line with some of the most important companies in the kingdom. All the railway companies and the banks were now holding only one meeting. He would also point out the inconsistency in their case of half-yearly meetings. They were of considerable inconvenience because the half years were not equal. They could not make the trading of one half year have any relation to the other half year; and it would be much fairer to take year by year. Besides, they were only proposing to follow the custom that was, he believed, absolutely universal abroad, of having only one meeting a year. The German and the French companies with which the Association were connected held only an annual meeting. He might say in this connection (although unfortunately he had not the exact words before him now) that he alluded to this very question some two or three years ago when he first had the honour of occupying the chair, and on that occasion no note of protest was raised by anybody. Therefore, for many reasons, both of expense and convenience, he would urge the proprietors not to in any way mistrust the Directors' proposal of having only one meeting a year. ["Hear, hear" from several proprietors.] As to the suggestion of Mr. Phillips, that after the word "light" in clause 3 of the Bill "heat and power" should be added, he did not see any objection.

The Solicitor said he would make a note of the suggestion; and if the Lord Chairman would pass the amendment, it should be done.

The motion was unanimously carried.

Sir John Runtz remarked that many of the proprietors would like to know the latest intelligence as to how the works of the Association stood—whether there was anything cheering to help them.

The Chairman replied that there was nothing fresh to add to what he said last November.

Moved by Sir John Runtz, and seconded by Mr. Vacher, a hearty vote of thanks was passed to the Chairman and his colleagues.

TOTTENHAM DISTRICT LIGHT, HEAT, AND POWER COMPANY.

The Half-Yearly Meeting of the Company was held last Saturday, at the Offices, No. 639, High Road, Tottenham—Sir Corbet Woodall, D.Sc., in the chair.

The Secretary (Mr. E. Topley) read the notice calling the meeting; and the Directors' report and the accounts were taken as read.

War Conditions—Gas Prices and Dividends.

The Chairman, in moving the adoption of the report and accounts, said, looking over the series of accounts which formed the history of the Company since the outbreak of war, perhaps the most striking impression one received was that of the steadiness with which the ill-effects accumulated as time passed. There was no going back. The cost of all materials continued to rise with a monotonous frequency; but considering the magnitude of the world war, it was almost surprising that this was not more pronounced. The lighting restrictions became gradually more severe. The pressure of the necessity for domestic economy, and its restrictions in the ordinary consumer's gas account, became more marked as each quarter passed. Reference was made six months ago to the circumstances under which the Directors had advanced the price of gas. A glance at the present accounts would show that the 4d. which they originally proposed, and which, in deference to the wishes of the Tottenham District Council, was reduced to 3d., would not have been adequate to meet all the various advanced charges and expenses; and it was clear that at Midsummer next a further considerable increase would have to be made in the price. The Directors had thought it right again to pay the full statutory dividends out of the undivided profit carried forward, which existed for this precise purpose; and they could congratulate themselves that the remaining accumulated funds of the Company would amply suffice to do the same again in June. But it was evident that it would then be quite time to advance the price of gas to such an amount as would meet the extra war charges, and provide the necessary profit to pay future dividends out of the revenue balance. This necessity further to advance the price, owing to the inadequate advance to which they agreed, was clearly foreseen when they laid their case before the Tottenham Council; but in their (the Council's) judgment consumers would be better able to pay the advance later on. He hoped so.

FINANCIAL QUESTIONS—COAL STOCKS.

The finances of the Company had caused the Directors a considerable amount of thought. Much money had been absorbed by the continued depletion of the amount carried forward as undivided profit, and by the unavoidable capital expenditure, both on the gas and electricity undertakings, and also by some unusual items, as, for instance, the quantity and value of coal stocks, which had risen from £4046 at Dec. 31, 1914, to £36,832 at Dec. 31, 1915—a most necessary increase. He ought, perhaps, to explain that in December, 1914, the stock of coal was so low as to cause considerable anxiety from day to day; and the increase from £4046 to £36,832 meant the absorption of a large amount of the sum available for floating capital. In this connection, it might be noted that coals came in very freely during the summer—partly due to the lighter demand freeing more coals, and partly due to the better working of the railways in the summer weather, with its longer hours of daylight. By the end of October, they had fortunately accumulated 42,000 tons of coal on the works. These stocks were enormous and unprecedented; and they almost feared that they were overdoing their accumulations in this direction. But since then matters had gone entirely the other way; and they were now reduced to 25,000 tons, and were still having to draw upon their coal reserve. The Company's bankers had willingly given assistance in regard to finance, and would continue to do so. The Directors had therefore considered it wiser to avail themselves of this assistance rather than issue fresh capital under the unfavourable conditions at present prevailing. It was better to pay a fairly high rate of interest for a short time than to burden themselves for all time with capital burdened with a heavy rate of dividend. The Directors had also thought it wise to convert the whole holding of the Company in Consols into War Loan on the conditions offered by the Government. The charges involved in the operation, together with the cost—in all £1480—appeared in the net revenue account.

ORDINARY AND COIN METER CONSUMPTION.

He had remarked that the ordinary consumers' accounts continued to show a decrease in average consumption. In each of the eight districts into which, for the purposes of organization, the ordinary consumers of the Company were divided, the average consumption, both of shops and private houses, had decreased since the commencement of the war. On the other hand, coin meters, which now numbered 57,881, against 22,557 ordinary, had steadily increased their consumption; so that, whereas the average consumption by coin meter during the year 1914 was 17,265 cubic feet, during 1915 it was 17,778 feet—an increase of 513 feet per meter, or 2·91 per cent. on the average. In addition, the number of consumers by coin meter had increased as compared with last year by 1422. The general prosperity of the users of this class of meter was also shown by the fact that the replacement of penny meters by shilling ones had been larger during 1915 than in any previous year. It had often been noted here that a large percentage of coin meter consumers changed their residences; and for several years the proportion of such removals per annum was about one-third of the total number. But during 1915 it was only about 20 per cent. A few years ago the number of coin meter installations in empty houses was very large. On Dec. 31, 1910, the number was 4724; but on Dec. 31 last, it was only 641—remarkable evidence of growing, though probably temporary, prosperity due to the influx of workers, chiefly engaged on munitions. The number of meters broken open had again fallen by over 50 per cent. in the year, which was perhaps further evidence of the prosperity of a section of the community. During the year, £120,628 in pennies passed through the coin meters, equal to a total weight of 258 tons, or an average of 5 tons per week.

DETAILS FROM THE ACCOUNTS.

Passing, now, to an examination of the accounts in detail, the capital account in regard to gas, although increased by £12,309, worked out at £433 per million cubic feet sold per annum—a usefully low figure brought about by liberal depreciations which had been continued during the half year by the writing-off at their customary rates of £8195 from the gas capital. The electrical capital had increased by £2065; but this was mainly due to payments of retention money on the original contracts falling due during the half year. In the revenue account, it would be seen that materials for gas making had cost more than in the corresponding half year by £22,346; and though about £9000 of this was represented by extra materials used, the balance, which was due to increased price, was considerable. The charge for repair and maintenance appeared high, as compared with the corresponding period of last year; but it was not really so, especially when the price of all materials was taken into consideration, as well as the fact that last year was exceptionally low, and the present year therefore appeared high in comparison. In distribution (particularly repairs and maintenance), they had been able to effect some considerable economies, and others had come of their own accord. For instance, it was their usual practice to lavish attention on the consumers in the matter of maintenance of mantles and other such services; but owing to the war, the Company were so short-handed that they had been compelled to curtail this service. Similarly with gas-stoves and all other appliances, the consumers had mostly been willing to bear their share of the burden, by being content to have done for them only those things which were absolutely essential. The advance in the item of rates and taxes was due to the large increase in income-tax. This item would be more appropriately placed in the net revenue account, and in future it was proposed that it should appear there. The charge for co-partnership was less by £500, owing, of course, to the lower rate of bonus, because of the increase in the price of gas. It was precisely the same as in the case of the proprietors, who had to suffer loss of dividend when the consumer had to pay a higher price. It was hoped that each one would bear his loss with fortitude, and that when better times came he would receive his gain with gratitude. Three items at the bottom of the debit side were all war-items—viz., payments to dependents of men on war service, war bonus on account of charges for increased cost of living, and air-craft insurance. There was more pleasure to be had from contemplating the two first of these, serious as they were, than from any of the other items of expense brought about by reason of the war, which from their nature gave neither pleasure nor satisfaction. During the half year, three more of their employees had lost their lives in the country's cause. They were J. Dickerson, who was killed in action in France, in September; H. T. White, who was killed in action at the Dardanelles in October; and E. Goddard, who succumbed from pneumonia resulting from exposure in the trenches.

GAS RECEIPTS, RENTALS, AND RESIDUALS.

On the credit side of the revenue account, the yield from gas was £16,500 more than last year—partly due to the increased output of 4·89 per cent., which represented about one-third of the increased amount, and the remainder was attributable to the increase in the price of gas. It had been remarked before that the Company's revenue grew more and more dependent on rental of appliances, which again showed an increase of £2500. This must be considered very satisfactory from the fact that no rentals were coming in from the high-pressure and other outside shop lamps, which were perforce idle at the present time, but which in the ordinary course provided a considerable income. With reference to residuals, coke showed a satisfactory increase; but much of this was paid by the Company for the coke used in the manufacture of carburetted water gas. The figure would have been better still if it had not been for several old contracts for coke made at low prices before the rise in value took place. These, fortunately, were now nearly all completed; and this year should show up still better in this item. Tar was disappointing for more than one reason. First, the price was steadily falling, principally because there was little outlet for pitch—the foreign markets having been entirely upset by the war. Secondly, the make per ton was only 8.86 gallons. In the previous half year, the apparent make was exceptionally high; and the suggestion made at the last meeting that this half year must come correspondingly low, turned out to have been a correct prophecy. Sulphate of ammonia presented a good return in ammonia value, which would have been still better if it had not been for forward contracts, and the very high price of acid and lime. On the whole, if they took into consideration the many disturbing elements and factors, the figures must, he thought, be regarded as satisfactory.

WORKING EFFICIENCIES AND LABOUR.

In regard to working efficiencies, these had been reduced as might naturally be expected. As they had one-third of their regular men away fighting, and others had gone to other employment, they were compelled to carry on with new hands who were not used to the work, and who would not be here if they were as young and strong and vigorous as those who had gone. The same shortness of labour and consequent inefficiency existed at the collieries. As a result, the coal which they received, and with which they had to get their results, was in many cases not cleaned as it should be.

ERRATIC METERS AND AN INQUIRY.

Further reference should be made to the unaccounted-for gas, which showed such a serious increase. The causes leading to this were many. They included variations in the date of reading the meter indices; but there was possibly a still more serious fault with the meters themselves. There had been developed in recent years—the last two or three—a considerable failure on the part of meters to register correctly. In a number of cases there had been failure to register altogether. At the instance of the meter makers, who thought the meters were being injured by alterations which had taken place in the manufacture of gas, a Committee had been appointed of representatives of the Institution of Gas Engineers and of the meter makers; and they were making inquiries into the subject, which, he hoped, would result in information of value.

THE ELECTRICITY INDUSTRY.

With regard to electricity, there was not much calling for public notice. The plant he had pleasure in saying had proved entirely satisfactory. It was equal to about six or seven times the quantity of current being sent out; and it would be noted that in the second half year of the establishment of the undertaking, it was paying its way, leaving a small balance to the good.

GAS-WORKS EXTENSIONS AND PROSPECTIVE NEEDS.

With regard to new works, the additional and separate section of gas-works designed for the production of 4¾ million cubic feet per day, which was to have been already for work for the present winter, was not completed owing to unavoidable delays, and the work was still making slow progress. This was causing them considerable anxiety. But the Directors hoped that next year the plant would be ready for full use. That the plant should be finished was the more imperative because there was strong probability that the carburetted water-gas plant would not be able to work for lack of the necessary oil for gas making. Gas oil at present was nearly unprocurable; and the price of it was almost prohibitive. Should it become necessary to give up the manufacture of carburetted water gas, the new coal-gas section would be absolutely necessary, and must be brought into full work. This would involve fresh difficulties in procuring the necessary additional coal for making gas by that system, and in the disposal of the resulting coke. These matters were engaging the constant attention of the Directors; and, notwithstanding the many difficulties, they hoped that the important work of the supply of gas to the community and industries the Company served might be successfully continued without any inconvenience or failure.

FREIGHT RATES AND A COMMISSION.

In some observations made in another place the previous day, he called attention to the grave burden imposed on users of coal, and especially upon gas companies, by the enormous charges now made for collier freights. It was high time the Government took strong action in the matter; and he was glad to see that a powerful Commission had been appointed to consider the propriety of taking over the control of the whole British commercial navy, and exercising control over the rates charged. Were it not for this, he should look to the coming year with consternation. With it he trusted, as he had said, that the Company would come through with credit and with satisfaction to the public.

Mr. Henry Bailey seconded the motion.

The Chairman, in reply to questions, said the main cause of the increase in the law costs was a case of a coke contract which, it was alleged, was not carried out properly, and upon which a claim was made. The Directors thought this was altogether unjustifiable, and took it into Court. The case was, with the concurrence of their legal adviser, the subject of appeal; and the Board hoped that the issue would justify their action. As to the dividend, there would be no further decrease at the next meeting; but if, as seemed inevitable, there had to be a further increase in the price of gas, it would carry the sliding-scale diminution of dividend.

The motion was carried unanimously.

The Dividends.

The Deputy-Chairman (the Rt. Hon. Sir Daniel F. Goddard, M.P.), proposed the payment of the full statutory dividends at the rates per annum of 7⅛ per cent. on the "A" stock, 5⅞ per cent. on the "B" stock, and 5 per cent. per annum on the preference stock. He remarked that some people might object to receiving dividends which had not been completely earned within the period covered by the accounts; but he hoped to be able to persuade the proprietors on this occasion not to advance any such objection. They had not earned the dividends recommended in the half year for reasons fully explained by the Chairman, but which he did not think in any sense necessitated them withdrawing from receiving their proper dividend. They would have to draw on what he might call their first reserve fund—that was, the balance carried forward, which had been accumulated in past years. And what better could they do with the balance than make up any deficiency in the dividend? He was sorry the dividend had been reduced; but this was a statutory obligation. They had to act differently to most other trading companies, who, when they made larger charges, generally made bigger profits; but in their own case when they made larger charges, they had to divide among the proprietors less profit. This being a statutory obligation, they submitted to it with as much grace as they could command. Of course, the sliding-scale operated both ways. He thought the cherry words of the Chairman with regard to the future were not too optimistic. The proprietors might rely upon that, as the Chairman would not have used the words he did if he had not meant what he said. He (Sir Daniel) believed that the diminution in the balance forward would very shortly be obliterated, and that the balance would again increase as time went on. There was every sign of improvement and progress in their working, which was very hopeful.

Mr. A. W. Reid seconded the proposition, and took the opportunity of congratulating Sir Daniel Goddard upon his elevation to the Privy Council.

The proposition was unanimously passed.

Votes of Thanks.

Mr. Herbert Michell proposed a very hearty vote of thanks to the Chairman and Directors, the Engineer (Mr. A. E. Broadberry), the Secretary (Mr. E. Topley), their respective staffs, and the workmen, for what they had done during the last six critical and difficult months. The proprietors, he observed, were very thankful to see Sir Corbet that day so very much better than he was two or three years ago. He emphasized the congratulations already offered to Sir Daniel Goddard on his elevation to the Privy Council, and expressed the hope that their Deputy-Chairman would prove one of the wise Privy Councillors. It was a great pleasure to see Mr. Randall present, as through an accident, which fortunately was not serious, he was unable to be at another local function a few days previously. Regarding their men, he understood that something like 220 had joined the Colours from the Company's employ; and the proprietors were glad to learn that only three of the number had during the last six months made the supreme sacrifice of laying down their lives for their country, and for the cause of right throughout the world. He hoped that in some way there would be expression of sympathy sent from the proprietors to the bereaved relatives. They also thought of those of their men who were fighting under circumstances of extreme hardship, and hoped that they would be spared to, at the conclusion of a glorious and blessed peace, return to the Company. They also sympathized with the Engineer and his staff, and the Secretary and his staff, in the difficult circumstances of the present time.

Mr. MICHAEL WILLIAMS seconded the motion, which was cordially agreed to.

The CHAIRMAN said that once again it was a great pleasure to him to return thanks for the resolution. More that day than ever in the story of the Company, so far as he knew it, was the resolution welcomed and, he ventured to say, deserved. Mr. Michell had referred to the six months as having been critical and difficult. They had been so to a degree that the proprietors could hardly appreciate. There were the difficulties of obtaining materials, and of constant increases in the cost of everything the Company had to buy. There was the difficulty of obtaining workmen to do the necessary work, and, when they were obtained, to teach them how to do the work, because those who were absent were acquainted with their operations, while those who came fresh to them had to be trained. The Deputy-Chairman, who was a member of Parliament and a Privy Councillor, and therefore one who knew most things that were going on, spoke of the probable short time before the war was over, and they began again to fill up their reserve, and all things would go merrily and happily. He (Sir Corbet) wished that he could at the present time feel and say that this would happen in a short time. However, the Company were in a position as favourable as he thought most companies were of which he knew to face another year of war conditions; and he sincerely hoped that at the end of it they might be in the condition that Sir Daniel forcasted. At any rate, the effort which the proprietors had acknowledged had been put forth by the Directors, the officers, and the workmen during the past six months, he was sure would not be withheld in the time to come; and, so far as possible, they would do all they could to keep up to the full the measure of good repute the Company had held in the past.

Mr. BROADBERRY (responding for Mr. Topley and himself, and their staffs) heartily thanked the proprietors for their recognition of their services. He remarked that they could fairly claim that they had done their level-best in their various spheres to make the business of the Company go as well as possible. He believed the staff, from top to bottom, felt that, in the present strenuous times, it was their duty, not only as servants of the Company, but as citizens, to do everything in their power to "carry-on" until better times came, and the proprietors might rely on them continuing to act in this way.

Ambulance Work.

The CHAIRMAN said that the Company's employees who were members of the St. John Ambulance Class had been working during the autumn and winter under the direction of Dr. M'Laren; and they were entitled to certain distinctions and awards, which were now to be conferred. Those of the proprietors who cared to honour the men by remaining could do so; but otherwise the business was concluded. [The proprietors all remained.] Proceeding, the Chairman said twenty-four of the men had attended the class; and he was proud to say that out of this number only three failed to pass. Even this was due to other important work which interfered with the regular attendance of the three at the class. [The certificates, medallions, and labels were then distributed.] Afterwards, the Chairman remarked that the large number of passes out of the total number was a great credit to the instructor. Dr. M'Laren received no fee for the work that he had done. But there was a feeling that this was an oversight, and ought not to be tolerated. He hoped that in some way this would be made good. At any rate, they were under an obligation to him for the work he had undertaken, and had done so successfully. He also wished to thank Captain Powell for the encouragement he had given to the men.

Captain POWELL, at the request of the Chairman, gave the proprietors some account of the work that was being done in the district; and, in the course of it, he acknowledged the great assistance rendered by the Company to him and those working with him in dealing with the conveyance of wounded soldiers to the hospital—particularly in the earlier stages of the war.

Regulating Coal Distribution.

Owing to the increasing demands of industries connected with the war, the difficulties with regard to fuel supplies, to which the Board of Trade called attention on Dec. 1 last, have become more pressing in certain districts. It was decided, therefore, to appoint, on the nomination of the various coalowners' associations, District Coal and Coke Supplies Committees, with the object of ensuring that munition firms and other important consumers obtain the supplies they need with as little delay and friction as possible. The question whether licences for the export of coal and coke can be issued will necessarily depend largely on the home demand being satisfactorily supplied. Committees have been formed, or are in course of formation, in various districts; and it will be the business of these Committees to see that the resources of their districts are utilized to the best advantage, and that the requirements of important industries are fully met. Any recommendations that they may be able to make with a view to greater economy in the use of coal will be carefully considered. It is not proposed to confer any special powers on the Committees. It is felt that both coalowners and consumers realize that the industries connected with the war must have precedence, and that some interference with the normal distribution of coal at the present time cannot altogether be avoided. Mr. Runciman has appointed a Committee to consider all questions relating to the distribution of coal and coke that may be referred to them from time to time by the Board of Trade or submitted by the District Coal and Coke Supplies Committees.

Professor Harold B. Dixon, M.A., Ph.D., F.R.S., of Manchester, has (according to the printed minutes of the Salford Corporation Gas Committee passed at last Wednesday's meeting of the Town Council) been appointed Gas Examiner for testing the gas supplied by Salford to consumers in the districts of Eccles, Swinton, and Pendlebury, for 1916, in accordance with the Salford Corporation Act, 1897.

NEWCASTLE AND GATESHEAD GAS COMPANY.

The annual meeting of shareholders in the Newcastle-upon-Tyne and Gateshead Gas Company is to be held next Tuesday, when the Directors will report that the revenue for the year ended Dec. 31 was £579,481, and the expenditure £454,937. With the amount brought forward, there is a total available balance of £131,123, which the Directors recommend should be appropriated as follows: Interest on debenture stock and loans, £29,968; interim dividends on the preference stock at the rate of 4 per cent. per annum, and on the ordinary stock at the rate of 4½ per cent. per annum, £44,866; final dividends at the same rates, £44,866—leaving to be carried forward £11,423.

The Directors go on to say that the quantity of gas sold during the year was 3,796,345,000 cubic feet—an increase over 1914 of 265,247,000 cubic feet, or 7·51 per cent. The revenue from gas was £367,378, compared with £322,302 in 1914; from residuals £151,556, against £127,435 in the previous year. The numbers of consumers, and apparatus out on hire, at Dec. 31 were: Consumers, 124,527 (increase 1404); cooking-stoves, 75,002 (increase 940); grillers, 10,406 (increase 254); gas-fires, 13,062 (increase 1041). The reconstruction of the carbonizing plant at the Elswick station has been completed; and the whole of the new plant is now in operation. Additional purifying plant at Elswick and oil-gas plant at Redheugh are in course of erection. Owing to delays arising from the war conditions, these were not completed in time to be in operation at the commencement of the winter season.

Having regard to the altered value of money brought about by the war, the Directors deemed it necessary to deposit a Bill in Parliament with the principal object of removing the restrictions which at present exist upon the Company's financial powers, and of increasing these powers so as to enable the Company when necessary to raise money on the best terms obtainable. The Bill will be submitted to the proprietors at an extraordinary general meeting, which will follow the ordinary meeting.

BRENTFORD GAS COMPANY.

Half-Yearly Report and Accounts.

In the report which will be submitted at the half-yearly meeting of the Company on Friday, the Directors state that the accounts for the six months ended Dec. 31 show a profit on revenue account of £49,829. After providing for fixed charges, and writing-down investments, there remains a sum of £39,456, which with the balance brought forward makes an amount of £106,581 available for dividends. The Directors recommend dividends, subject to income-tax, at the rate of 5 per cent. per annum on the preference stock, at the rate of £5 12s. per cent. per annum on the "A" consolidated stock, and at the rate of 5½ per cent. per annum on the "B" consolidated stock. As compared with the corresponding half year, the gas sold shows an increase of 4·43 per cent. The total number of consumers is 117,357 (including 6215 for Staines and Sunbury, not included last year), as against 108,978 last year. The Directors have been compelled, in consequence of the increased cost of coal and oil, to raise the price of gas, from Christmas last, from 2s. 4d. to 2s. 6d. per 1000 cubic feet. This increase will involve a small reduction of dividend to the shareholders. The Directors propose that in future there shall be only one general meeting of the proprietors each year—in the month of February—instead of half yearly, as heretofore.

The accounts accompanying the report show that the revenue from the sale of gas amounted to £222,684; from the rental of meters, stoves, and fittings, to £42,775; and from the sale of residual products, to £63,795—the total receipts being £329,324. The expenditure on the manufacture of gas was £198,797; on distribution, £37,895; on management, £9716; on rent, rates, and taxes, £15,164—the total expenses being £279,495. The balance carried to the profit and loss account is £49,829.

The working statements indicate that 99,290 tons of coal and 1,785,424 gallons of oil were used in the past half year in the production of 2,071,735,000 cubic feet of gas (including 857,508,000 cubic feet of carburetted water gas), of which 1,885,501,000 cubic feet were sold and 1,916,662,000 cubic feet were accounted for. The estimated production of residuals was: Coke, 61,983 tons; breeze, 9073 tons; tar, 1,338,442 gallons; ammoniacal liquor, 29,642 butts.

SOUTH SUBURBAN GAS COMPANY.

Half-Yearly Report and Accounts.

The following is the report of the Directors of the Company—signed by Mr. Charles Hunt, as Chairman—for the half year ended Dec. 31. It will be presented at the ordinary general meeting next Friday.

The net revenue account shows that, including the balance of £5073 brought forward from last half year, and after providing for debenture and other interest, the amount available for dividend is £34,109, out of which the Directors recommend the payment of statutory dividends (less income-tax) as follows: On the 5 per cent. preference stock, 5 per cent. per annum; on the 5 per cent. ordinary stock, £4 16s. 8d. per cent. per annum; on the 5 per cent. West Kent ordinary stock, £4 16s. 8d. per cent. per annum—leaving to be carried forward to the next half year £6320.

The sales of gas show an increase of 1·01 per cent., as compared with those for the corresponding half of the previous year. The number of consumers has increased in the half year by 1210, and of cookers, gas-fires, &c., in use, by 3393.

Coal deliveries have been well maintained throughout the winter; but the unexpected continuance of excessive freight charges is causing much anxiety.

There has been an excellent demand for coke, though its delivery to consumers has been seriously interfered with by congestion of railway traffic, and scarcity of conveyances for road transport. Sulphate of ammonia has also been readily sold at advancing prices.

Conversion of the Company's investments in Consols into War Loan Stock has been effected at market prices. Other investments have also been written-down, so that the amounts now standing to the credit of the reserve and special purposes funds respectively represent as nearly as practicable current values.

The number of the Company's employees who had joined the Colours by the end of the year was 250; and at that date every medically fit member of the staff of military age had either so joined or been attested for service.

The Directors who retire by rotation at this meeting are Mr. Charles Hunt and Mr. Charles Carpenter, D.Sc., both of whom being eligible offer themselves for re-election. One Auditor, Mr. Samuel Wood, F.C.A., also retires by rotation, and being eligible offers himself for re-election. Mr. George Ross, the retiring Employee-Director, has been re-elected without opposition.

The accounts accompanying the report show that the total capital expenditure at the close of the half year (including the nominal amount added by conversion) was £1,399,135 3s. 11d., or £12,430 3s. 11d. more than the receipts—viz., £1,386,705, inclusive of the premium capital. A sum of £1226 9s. 8d. was expended on capital account in the half year. The revenue from the sale of gas was £156,955; the rental of meters, stoves, and fittings produced £18,692; the sale of residuals, £57,888; and the total receipts were £233,964. The following were the principal items of expenditure: Gas manufacture, £129,798; distribution, £43,575; management, £8464; rents, rates, and taxes, £7656; and miscellaneous items bringing up the total to £198,854. Among the items is one of £1000 charged on account of the co-partnership scheme. The balance carried to the net revenue account is £35,109; and the amount available for dividend is £34,109.

The statements as to working show that, under the supervision of Mr. S. Y. Shoubridge, the Engineer, 71,204 tons of coal were carbonized and 590,907 gallons of oil used in the half year. The quantity of gas made was 1,149,041,000 cubic feet (252,423,000 cubic feet of oil gas), of which 1,027,769,800 cubic feet were sold and 1,037,962,000 cubic feet were accounted for. The residuals made were: Coke, 46,276 tons; breeze, 15,922 yards; tar, 747,903 gallons—the make of sulphate of ammonia being 798 tons.

EDINBURGH AND LEITH GAS COMMISSIONERS.

Additional War Bonuses—Sale of Gas.

The Edinburgh and Leith Gas Commissioners have again had under consideration the question of the workmen's wages; the subject having been raised by the Edinburgh Branch of the National Union of Corporation Workers. The Commissioners met a deputation from the Union on Dec. 13; and on Jan. 3 the Consulting Engineer (Mr. W. R. Herring) and the Resident Engineer (Mr. Alexander Masterton) issued a joint report, in which they reviewed the duties and wages of the men, and came to the general conclusion that they were being amply paid for their services. "If, however," they remarked, "the Commissioners consider that the plea of increased cost of living now put forward—although given effect to in the war bonus granted in April last—is justified, we feel that an adjustment on this scale is the proper means by which a temporary advance in the cost of living should be met." They suggested the following additional bonus for permanent workmen in the manufacturing and distribution departments, excluding men on war service and tradesmen receiving the recognized trade rates or their equivalents:

Wages.	Additional Bonus.	Total Bonus.
20s. to 30s. per week	2s. 0d.	4s. 6d.
Above 30s., but not exceeding 35s.	1 6	3 6
Above 35s., ,, ,, 40s.	1 0	3 0

As regards meter-readers, they were of opinion that the present minimum of 24s. per week should remain, but that the present maximum of 35s. should be raised to 40s., or, alternatively, a war bonus of 3s. 6d. per week. They further advised the giving of an all-round bonus of 3s. per week to the permament members of the clerical and administrative staffs whose wages amounted to 40s. and under; those with wages over 40s. and under 43s. to have the difference made up. They estimated the annual cost of the suggested bonus at £2143.

The Commissioners decided unanimously not to alter wages in any case, but to grant, as from Nov. 15 last, the additional war bonuses recommended by the Engineers. It was further agreed that the bonus scale applicable to the clerical and administrative staffs in the Engineer's department should also apply to the Treasurer's clerical and collecting staff.

A letter from the Town Clerk of Edinburgh, with reference to the proposed experimental installation of apparatus for the automatic lighting and extinguishing of public lamps, was remitted to the Works Committee.

The Treasurer (Mr. A. Canning Williams) reported that the total quantity of gas sold during the summer and autumn term (six months) was 753,106,000 cubic feet—a decrease of 2·41 per cent. on the corresponding period of 1914. The gas consumed by the public lamps amounted to only 873,000 cubic feet, against 30,163,800 feet in the same period of the previous year—a fact which more than accounted for the decrease in the total sale.

The Spenborough District Council recently decided to increase the salary of the Gas Manager (Mr. A. E. Jennings) from £200 to £250. The increase was opposed by the Labour party in the Council; but it was shown that the increase was a fulfilment of an implied undertaking given at the time Mr. Jennings was appointed, and several members held that some injustice had already been done to him by undue delay.

SOUTH METROPOLITAN COMPANY'S CHIEF ENGINEER.

Mr. Gill's Message in the "Co-Partnership Journal."

The following words of greeting to the employees, by Mr. G. M. Gill, the newly-appointed Chief Engineer, appear in the February issue of the South Metropolitan Gas Company's "Co-Partnership Journal."

Being a newcomer to the Company, I have been asked by the Editor to write something for the "Co-Partnership Journal;" and it is a request to which I acceded quite readily, but, I fear, without considering whether I could write anything which would be of interest to you. I may say at once that I am very proud indeed to be a member of the South Metropolitan Gas Company. Its great traditions have been for years the admiration of the whole gas industry; and this should be a source of pride to all those who form the links of this very substantial chain. Its pioneering work in strengthening the foundation on which the industry stands, and its timely and skilful investigations into matters which so urgently needed attention, have earned for the Company a great reputation among not only the gas industry, but a huge public outside. Therefore, I have every reason to be proud of being accepted into your ranks.

I have for years had experience of co-partnership in the Company which I have just left, and have always been an admirer of its advantages, which are so substantial and so obvious that it should only be a question of time before the whole industrial world is governed on similar principles. Here, again, our great Company was a pioneer in the face of immense difficulties.

The limited time—a few weeks only—during which I have been in the service of the Company is altogether too short for me to be able to make any observations upon any particular points which have already impressed themselves upon my mind; but at this early stage I can say that if those I have already met of the employees of the Company are representative of the whole body, I am indeed pleased at the prospect of working among you. I am deeply anxious to work in harmony with both staff and workmen, and equally anxious to act fairly to all. It will not be out of place to state here that, so far as I am concerned, only merit will count when promotions are being considered. I am, and always have been, partial to the keen and hard worker, who studies his Company's interests before his own. This is in no case a hardship; for in studying his employers' interests he is looking after his own in the most effective manner. I am a believer in the value of athletics and games, partly for the healthy exercise which they give the body, and partly for the sportsmanlike spirit which they help to develop. This spirit is a great asset in dealing with our fellow-men, in whatever rank of life they may happen to be. By a sportsmanlike spirit I mean a spirit which considers impartially the other man's point of view; that takes no unfair advantage of a superior position; and that makes a man act in a straightforward manner, apart altogether from personal considerations.

In conclusion, I will take this opportunity of wishing all co-partners a "Happy New Year," in the course of which we all earnestly trust that a victorious peace will ensue.

COLCHESTER GAS BILL.

The Gas Company's Proposals Discussed.

The report of the Special Committee appointed to consider what steps should be taken regarding the Gas Company's Bill was presented at the meeting of the Colchester Town Council last Wednesday.

The Committee stated that Messrs. Baker and Sons (Parliamentary Agents), who had acted for the Corporation on former occasions, had reported that the Colchester Gas Company had not been to Parliament since 1875, and had now deposited a Bill very largely to increase their powers. It was therefore necessary that the application of the Company should be closely scrutinized, and care taken that the powers granted them should not enable them to stay away from Parliament for another forty years. The Committee pointed out that the Company's capital had all been raised and spent, that their borrowing powers were exhausted, and that they were overspent by upwards of £2600. The Company were limited to maximum dividends of 10 per cent. on the original capital and 7 per cent. on the capital issued under their 1875 Act; and the profit revenue for the last year was in excess of what was required for the payment of these dividends. A considerable sum had also been obtained by the Company by way of premiums which carry no dividends; and there was also £13,000 carried forward in excess of the Company's statutory powers, which would be included in the purchase, subject to the amount of the next half-year's dividends, £2050. The Committee were of opinion that the Company had committed other statutory irregularities, which would have to be looked into. Having regard to the fact that war was pending, provision had been inserted in the recent case of Skegness that the undertaking should vest in the Corporation on or about the date of the award, but the purchase price need not be paid until after the war. In the meantime, the Company were to be paid interest on the amount of the award, and the profits to go to the Corporation. In the case of Chelmsford, which was now acquiring (after opposition) the undertaking there, payment is deferred until the Corporation can borrow the money after the war—they paying 5 per cent. in the meanwhile.

From the clauses of the Bill, it appears that some portions of the existing gas-works have been erected on lands which are not authorized to be used for gas manufacturing purposes, and the Bill seeks to rectify this. It also seeks to authorize the Company to acquire more land for the extension of their works, and to construct other works, which will cause some interference with roads. The Bill proposes to extend the limits of supply so as to take in all surrounding parishes as far as Great Bromley on the east, Copford on the west, Langenhoo on the south, and Boxted on the north; and it will be known that already the Company have laid some mains for supplying gas outside the borough without any statutory authority. The effect of such a great enlargement of limits would be to enable the Company to spend in the outlying area revenue earned in Colchester, and, should the extensions of mains into that area not prove advantageous, the profits of the entire undertaking might be seriously decreased, and the price of gas might even have to be increased instead of being reduced. Under the Company's existing Acts it is incumbent upon them to supply gas of an illuminating quality of 16 candles, and the test prescribed for the quality is that of illuminating power. The Company seek, however, to substitute for this gas of much inferior quality, which might not be equal to more than 11 or 12 candles; and they desire to test for heat instead of illuminating power. It might be that the calorific test could not be successfully objected to, as it had been inserted in recent Acts; but it should be pointed out that the reduction in the quality of gas would represent an additional profit to the Company of about 1½d. for every 2 candles, and, as the apparent reduction would be from 16 to 12 candles, they would get an increased profit of 3d.

On the point of pressure, the Committee were advised that an alteration should be made in clause 25. In the case of the Isle of Thanet Gas Bill, 1914, the 8-10ths of an inch of water (as mentioned in the Model Clauses and in the Company's present Bill) was increased to 2 inches. On the question of capital, the Company propose an increase of £125,500, which would be more than double their present capital; and the amount, if allowed, would probably last them for fifty years, during which period the Corporation would not have a like opportunity of purchasing the undertaking, or obtaining any concessions. After referring to the sliding-scale proposals, the Committee urged the Council to ask for the insertion of the optional purchase clause, and therefore lodge a petition opposing the Bill.

Mr. Wallace, speaking in favour of the adoption of the report, said that to support the petition in Parliament and oppose the Bill would cost from £200 to £300. Before, however, such a position was arrived at, they hoped to meet the Directors of the Company in a friendly spirit, and to agree on many points so as to lessen costs. He could not help thinking that, after full consideration, the Directors and shareholders would see that it was in the best interests of all concerned to come to an agreement. The Colchester Water-Works, which were acquired in 1879, had contributed to the district fund in relief of the rates a sum of £39,345.

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A Special Committee of the Bradford Corporation appointed to consider applications by employees for increases in war bonus, or the abolition of bonus and increase of wages, have decided to recommend that it is desirable to maintain the principle of adjustment of wages during the war by bonuses rather than wage revision, and that the bonuses be revised on the following basis: Men over 19 years of age, an increase of 3s. per week where wages do not exceed £3, the increase not to make the wage higher than £3; male employees under 19, 2s.; female employees, 2s. per week all round, the maximum the same.

STOCKPORT GAS-WORKERS' ARBITRATION.

Further Advances in Wages.

At the Monthly Meeting of the Stockport Town Council last Wednesday, the minutes of the Gas Committee were submitted for approval. They showed that further questions had arisen out of the terms of settlement reported in the "JOURNAL" for Jan. 11 [p. 99.].

Mr. S. Meunier (the Gas Engineer) reported that on Dec. 31 a number of men in the carbonizing department threatened to leave work, and actually did put down their tools and go into the mess-room; but after an interview with the Chairman (Mr. J. Winter, J.P.) and himself, they had resumed work. The Committee decided to request the General Secretary of the Municipal Employees Association to attend their next meeting. At a meeting the week following, the Secretary attended, and put forward a number of claims on behalf of the workers. A deputation from the employees also attended, in support of an application for an advance in the wages of the gas stokers. It was decided to advance the stokers' wages from 5s. 9d. to 6s. 1d. per shift. The consideration of other employees' wages was deferred to another meeting. Carters' wages were advanced to 29s. per week.

THE EXPLOSION AT A BLACKBURN GAS-WORKS.

Gas-Workers' Representative's "Challenge."

The members of the Blackburn Town Council had another long and stormy sitting on Thursday evening; and towards the end of the proceedings reference was made to the recent explosion at the Addison Street Gas-Works, caused by the safety doors of the water-gas plant being tied down. At the last meeting of the Council, Mr. E. Porter, the local representative of the National Union of Gas Workers and General Labourers, sought to have an inquiry made into the cause of the explosion by a representative Sub-Committee [*ante*, p. 100]; but this was negatived. Mr. Porter stated at this meeting that he knew the name of the man who had caused the explosion; that the explosion was not caused deliberately or maliciously; but that he demurred to giving the employee's name without certain safeguards. In a letter to Mr. J. R. Clynes, M.P. (the General Secretary of the men's Union), Mr. A. Morton Fyffe (the Gas Manager) recounted the facts, and stated that the Gas Committee had placed the matter in the hands of the Chief Constable of Blackburn for investigation.

The reference to the explosion arose out of a side-issue which had no connection with gas engineering matters at all. Mr. Porter introduced a subject, of which he was understood to say he had given previous notice, regarding the dismissal of a meter inspector of 28 years' service. The speaker alleged that the man had been dismissed because he was

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said to have made a statement to a third party which reflected upon Mr. Fyffe. The meter inspector referred to had requested that he should be confronted with the person who had made the allegation, but this had not been granted. The Gas Engineer had, he said, constituted himself prosecutor, jury, and judge in the case. Meter inspectors visited thousands of houses in a quarter, and in many they were liable to be drawn into a conversation on gas matters. If everyone was to be allowed to report any unfortunate statement a man might make, the lives of the employees would be intolerable.

Mr. J. W. Holgate (the Vice-Chairman of the Gas Committee) said that Alderman Nuttall (the Chairman) and himself went very carefully into the facts of the case, and communicated their finding to the Gas Committee. All the members of the Committee, except Mr. Porter, agreed with the action that had been taken. They did not think it necessary to see the employee; for, having confidence in Mr. Fyffe, they knew he would deal impartially with him and any man at the works. Mr. Fyffe intended that the works should be carried on on businesslike lines; and he urged the Council, by rejecting the resolution, to indicate the confidence they had in their Manager.

Other speeches followed in like strain; Mr. Dean remarking that Mr. Porter had said it was unfair the name of the person who had made an allegation against the meter inspector should be withheld. He would remind Mr. Porter that at the last Council meeting he was asked to state the name of the man who had caused the explosion at the gas-works; but he refused to do so. If it was unfair to give the name then, it would be equally so now. When the Chairman and Vice-Chairman of the Gas Committee, who were unbiassed, and had no desire to injure a workman, told them they had fully investigated the case, and approved of what had been done, they could safely leave the matter in their hands.

Mr. Porter said he insisted on the matter going to a vote. He denied that the workman referred to had had a proper hearing. An inquiry ought to be held; and if it was then found that the Manager was correct, then nothing would have been lost. He was perfectly prepared to accept Mr. Dean's challenge. If the Mayor (Alderman Nuttall) would produce the persons who reported the meter inspector, he would produce the man who was responsible for the gas explosion. He accused those responsible for the gas management of taking advantage of the fact that the gas workers had promised not to strike during the war, and contended that unrest would prevail so long as they stuck to present methods.

By 35 votes to 5, the resolution was lost.

* * *

Price of Gas at Barry.—The question of the advisability of increasing the price of gas was raised at a meeting last week of the Barry Gas and Water Committee. It was stated that the only alternative to such an increase would be an addition to the rates in the future. It was, however, agreed that the price of gas should remain as at the present time.

GLASS TRADE IN THE MIDLANDS.

Manufacturing Lighting Ware.

In connection with the recommendations favouring "reasonable import duties," which are contained in the report published last Thursday of the Sub-Committee of the Advisory Committee to the Board of Trade on Commercial Intelligence, the "Birmingham Post" on Friday made the following remarks on the glass trade—one of the industries to which inquiries were directed by the Committee.

Manufacturers in the table and lighting glass trade are of opinion that only total prohibition of German and Austrian imports for three or five years, and a substantial tariff afterwards, can secure the British market for the home manufacturer. In lighting glass particularly, Germany and Austria have done an enormous trade in recent years, largely in consequence of the cheap production which follows from the employment of child labour and the dumping of surplus products here at a ruinously low price; while in their own protected market very much higher values obtain. Cheap railway and canal freights also have assisted them materially. At a meeting of the trade the other day, it was responsibly stated that a case of Silesian glass could be delivered in Birmingham at a rate no higher than that charged by our own railway for the transport of a similar case from Birmingham to Wolverhampton. It cost twice as much to send a case of glass to the Continent as to send a similar quantity from Silesia or Bohemia to this country.

British manufacturers of flint glass are to day producing enormous quantities of lighting and table glass; but their prices are from 100 per cent. to 400 per cent. higher than those charged for imported glass before the war. Speaking on this question yesterday, a member of a Midland glass firm said the prohibition and tariff would give the local manufacturer time to pull his trade together and confidence to embark new capital on premises and plant, and to develop new processes. The war, by cutting off supplies of certain materials and restricting labour, had done a good deal for them; and they were able to produce more economically in several directions to-day. More important, however, was the fact that now factors were giving them orders for ten thousands where formerly they had difficulty in securing orders for hundreds; and prohibition or a tariff would perpetuate this advantage. If this tendency continued, manufacturers would feel themselves justified in remodelling their works and making moulds which the smallness and variety of the orders at present prohibited. The public, he admitted, were paying very high prices for all kinds of glass to-day; but there need be no fear that these prices would continue if the British glassmakers were given an opportunity enormously to increase their outputs, as they would if there were a reasonable measure of protection against dumped glass.

Before the war Germany supplied the great bulk of the glass for electric glow lamps manufactured in this country. Late in 1914 the

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British manufacturer commenced the production of these bulbs, and has supplied increasing quantities to the lamp manufacturer. The price has, however, varied from 100 to 200 per cent. in excess of that charged for the imported bulbs, as manufacturers had had no previous experience of the trade. Materials and labour were high in cost, and staffs had to be trained. Manufacturers, however, hold out small hope of being able to produce at the prices of the imported glass for a long time to come; but were the trade given an opportunity to establish itself, and an enormous consumption assured to it, it is believed the margin might be much reduced. Unless substantial protection is given to the trade, it will be lost to this country immediately Continental countries are allowed to export. This is the statement of a member of a Midland firm of flint-glass makers who has undertaken the production of electric bulbs. A small tariff of only 5 per cent. is advocated on glass bottles. Manufacturers recognize that, owing to the difficulty of training workmen, and the provision of new plants, it must be a long time before they could produce anything like the bulk required in this country. A Birmingham manufacturer expressed doubt as to whether a 5 per cent. tariff would be sufficient to induce makers largely to increase their output and train staffs.

NOTES FROM SCOTLAND.

"Scottish Gas Industry" Motor Ambulance.—Mr. Alexander Masterton, the Engineer and Manager of the Edinburgh and Leith Gas Commissioners, in his capacity of President of the North British Association of Gas Managers, performed an interesting little ceremony at Glasgow on Wednesday last [see p. 301], when, in the presence of a large attendance of representatives of the principal Scottish gas undertakings, he handed over to the Scottish Branch of the British Red Cross Society a fully-equipped motor ambulance. Mr. Masterton stated that an appeal for subscriptions had been made to gas undertakings, managers, and employees in Scotland, and that over £400 had been raised. In accepting the gift, the Hon. Treasurer of the Scottish Branch of the Society said that they now had 174 motor ambulances in use at the front, and all were manned by Scotsmen.

Breakdown at Perth Gas-Works.—The Gas Committee of the Perth Town Council had before them last Tuesday the report which had been prepared by Mr. John Lambert, the Burgh Electrical Engineer, at the request of the Emergency Committee appointed a few weeks ago, consequent upon the recent breakdown at the gas-works. The report had previously been considered by the Emergency Committee, and submitted by them to the principal Committee, with the recommendation that the work suggested should be carried out, and a remit made to the Emergency Sub-Committee to see this done. The report contained some very pointed references to the condition of the electric stoking plant at the works; it being suggested that it had apparently been constructed with the expectation that there would never be any breakdown or renewals required. The arrangement of the machines was such that to effect renewals meant a considerable waste of time. One point on which stress was laid by Mr. Lambert was that the vital parts of the machinery seemed to be the most inaccessible for repairs or renewals. He recommended that spare armatures should be provided for all the machines, and said that with the alterations suggested by him it should be possible to effect a renewal in a much more limited space of time than is required at present. The condition of the power-house at the works also came in for severe criticism. It was, he said, damp, and unsuited for the plant, which seemed to be in such a condition as to demand immediate attention. Mr. Lambert made some other recommendations. In the discussion on the report, it looked on occasion as if friction was to arise between the supporters of the electric stoking plant and the members who opposed its introduction to the gas-works. In the end, however, the recommendation of the Emergency Committee was approved; and it was remitted to them to carry into effect the suggestions made by Mr. Lambert.

Glasgow Private Street Lighting Charges.—A meeting of the Glasgow Corporation Committee on Objections to Assessments was held a few days ago, to consider appeals by certain houseowners in various parts of the city against being charged the usual rate of 15s. per lamp per annum for the lighting of private streets and courts. [See "JOURNAL," Dec. 7, p. 549.] The appeal was on the ground that many of the lamps at present are unlit. In view of the darkening of the streets being a temporary expedient arising out of the exigencies of the war, a Committee, at a meeting in November, held over the appeals, on the understanding that the Corporation would refund the money if the appeals were sustained. At last week's meeting, it was pointed out by the appellants that the circumstances were unchanged. Treasurer M'Millan (who presided) said the Committee had very carefully considered the appeals. While the lights that had been put out were extinguished on the instructions of the military authorities, the Committee, according to the wording of the Act, had no other course open to them but to sustain the appeals for the period during which the lamps were unlit. The question arose as to whether this decision should apply only to owners who had appealed; but the Court thought it fair the concession should be made to all who were similarly affected.

Perth Gas-Workers Wages.—The dispute which has been pending for some time between the Corporation of Perth and the employees at the gas-works has reached an interesting stage. After a debate at the last meeting of the Town Council, it was resolved to invoke the aid of the Board of Trade in the matter; and on Monday of last week the Town Clerk received a letter intimating that Sheriff Mackenzie (of Inverness) had been appointed as Arbitrator in the dispute. The question of the gas-workers' remuneration has been hanging fire for a considerable time. Shortly after the outbreak of war the Council passed a resolution by which it was agreed that no increase of salary or wages should be given during the course of hostilities. The employees at the gas-works, as well as other men in municipal service, made a request for an advance of wages, and while other fellow servants in different grades of service were content with a refusal of their application, the

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gas-workers persisted in their demand for a rise of 1d. per hour. A firm attitude was adopted by the councillors; and the men then placed their case in the hands of the Gas-Workers' Union. An official from this body was received by the Gas Committee; and he made a request for the men to be paid trade union rate of wages. This led Lord Provost Scott and other members of the Council to hint that, if the men persisted in being paid at trade union terms, the Municipality might be compelled to withdraw their scheme of pensions to old and retired servants, and other privileges enjoyed by the men.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Feb. 7.*

As anticipated a short time ago, rates of freight on pitch to the French Mediterranean ports have fallen substantially, but still are at a very high figure. Makers still quote 19s. to 19s. 6d. per ton net at works for pitch—with little business doing. The value of 90-160 solvent naphtha is 2s. 2d. to 2s. 3d. net per gallon in bulk at makers' works; while considerable business is reported in creosote at over 4⅛d. per gallon net in bulk.

A good trade with home farmers is being done at the special price arranged by the Sulphate of Ammonia Association. For export the value is unchanged at £17 5s. net per ton, filled into buyers' bags at makers' works, for 25 per cent. quality.

Tar Products in the Provinces.

Feb. 7.

There is nothing fresh to report concerning the markets for tar products. Pitch is still very quiet and difficult to sell. Creosote is weak, and no prices are reported to have been accepted. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 3d. to 22s. 3d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. 1d. to 2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅝d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Feb. 5.*

Throughout the week the market for this material has remained idle, as it has been impossible to do business for shipment to foreign countries, and the demand for home requirements has only been on a limited scale. The nominal values for export are £17 2s. 6d. to £17 5s. per ton f.o.b. Hull, £17 5s. to £17 7s. 6d. f.o.b. Liverpool, and £17 7s. 6d. to £17 10s. f.o.b. Leith, for early delivery. No first-hand transactions have been reported in the forward position, and evidently buyers and sellers have both adopted a waiting policy.

Nitrate of Soda.

Owing to the arrival of fresh supplies in this country, the market has become easier, and the spot quotations are now 16s. 6d. per cwt. for ordinary, and 17s. 3d. for refined quality.

Sulphate of Ammonia.

From another source, it is stated that prices have been considerably lower during the past week Outside London, makes are quoted at £16 12s. 6d; Hull, £17 15s.; Liverpool, £17 7s. 6d.; Leith £17 7s. 6d. to £17 10s.; Middlesbrough, £17 7s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The large amount of coal needed by the Government has stiffened the market, and made fuel rather scarce for the moment; so that some large collieries have little coal free for early sale. Prices, therefore, are rather irregular. Best Northumbrian steams are nominally 30s. per ton f.o.b.; and second-class steams are about 26s. to 27s. per ton. Steam smalls are also strong, and are quoted from 13s. to 17s. per ton f.o.b., according to class. Production is good; and the demand is heavy, especially for early shipment. This pressure for shipment is accompanied by some ease in freights, especially to the Mediterranean; but to the Thames there is not much difference yet. In the gas coal trade, there is a full demand, and best Durhams may be said to be about 25s. per ton f.o.b.—early supplies being still somewhat scarce. Second-class gas coals are steady at 22s. 6d. to 23s. per ton. For "Wear Specials," the market is active, and the quotation is from 25s. 6d. per ton f.o.b. Deliveries on the long contracts are fairly good at present; and there is now a slight reduction in the consumption. Little is being done in new contracts; but easier freights to Genoa may cause sales and a few cargoes. The collieries, however, sell with caution, and seem to vary quotations with the altering conditions. There are some buyers who still hold back; so that negotiations are not as far advanced as is sometimes the case for gas coal for the season's shipments at this time of the year. Coke is generally steady. Good gas coke is in tolerably full supply, and may be quoted from 27s. to 29s. per ton f.o.b. in the Tyne.

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Oldham Plumbers and the Corporation Gas Committee.

The dispute which arose between the Oldham and District Amalgamated Building Trade Workers and the Oldham Corporation Gas Committee, regarding rates for fixing gas apparatus, has now been settled. A fortnight or so ago, the General Manager of the Gas and Water Departments (Mr. Arthur Andrew) reported that he was without a decisive answer to the offer made by the Committee on Dec. 15 last. It was then decided by the Committee that, unless the terms were accepted by Jan. 26, they would be withdrawn. A deputation composed of Mr. Percy Skipworth, President, and Mr. John W. Vaughan (the Secretary of the Amalgamated Building Trade Workers) has since waited on the Gas Committee, and signified their acceptance of the conditions laid down by the latter—namely, "That the Gas Committee agree to pay the standard rate of wages of plumbers to all the men employed in the gas department engaged on the fixing of gas-fires, geysers, and the running, fixing, bending, and jointing of all pipes in connection therewith, on the consumer's side of the meter; but this resolution is not to apply to the fixing of gas-cookers and the pipes in connection therewith."

◆

Grantham Water Company.—The half-yearly meeting of the Company was held last Tuesday, Mr. J. G. Thompson presiding. The Directors reported that the balance in favour of the Company was £6062; and out of this they proposed the payment of a dividend at the rate of 5 per cent. per annum, carrying forward the balance to the next account. The report was adopted, and the resolution as to the dividend was duly passed.

Gas Matters at Ripon.—At a meeting of the Ripon City Council last week, Mr. Thorpe complained of the omission from the minutes of the record of business transacted by the Gas Committee on Jan. 24. He moved that, "subject to borrowing powers being obtained, the contract for the erection of new plant at the gas-works be open to competition, such tenders to be submitted to the full Council; and the Gas Committee be not empowered to bind the Council to any firm to carry out the work." The motion was carried. Mr. Brown (the Chairman of the Gas Committee), in reply to questions, said the Committee were convinced that the vertical retort system was the best. Alderman Thirlway remarked that he was not satisfied with the way the thing was going on; and he moved "that another engineer be called in to report on the advisability or necessity of a new class of retorts; and as to whether the works could not be put into full working order until after the war, when prices would be lower." Alderman Metcalfe observed that the passing of this motion would put the Council in a peculiar position in regard to Mr. J. Wilfrid Dunn, whom they had already engaged. The amendment was carried by eight votes to three; but a motion that the proposed payment of 50 guineas to Mr. Dunn, in the event of the scheme not going through, should be referred back, was lost.

Swansea Gaslight Company.

The report of the Company for the year ended Dec. 31 states that, an interim dividend for the half year ended June 30 having been paid, the Directors now recommend the declaration and payment of the statutory dividend at the rate of 5 per cent. per annum (less income-tax) for the half year ended Dec. 31. The past year has been abnormal and unprecedented in regard to the high prices of coal, oil, materials, and cost of production. The popularity of gas, however, proved greater than ever, and, despite economies, particularly in public lighting—the reduced consumption amounting to over 70 per cent.—the total sales of gas compare favourably with the previous year. Acting under instructions from the Ministry of Munitions, the Company have been producing and recovering toluol and benzol. With great reluctance the Directors were compelled to increase the price of gas in July (eleven months after the outbreak of war) to enable them to meet the enormously increased cost of raw materials; and it was regretted that the continued and unfortunate development of these increases, principally in wages, will render necessary a further temporary increase in the price of gas in the near future. The works, plant, and mains have been maintained in an efficient condition. It has been rendered impossible to commence constructional operations on the new works site at Morriston, owing to the obvious adverse circumstances. In order to provide for the present developments in the Company's business, application is being made to the Treasury for sanction to an issue of capital, the greater portion of which will be expended on additional manufacturing plant, thereby increasing the producing capacity of the works by over 20 per cent. The Directors, therefore, shortly anticipate inviting tenders for a small amount of 5 per cent. ordinary stock. The financial strength of the Company has enabled the reserve fund investments to be written-down to their market values on Dec. 31, and leave a substantial reserve fund of £25,651.

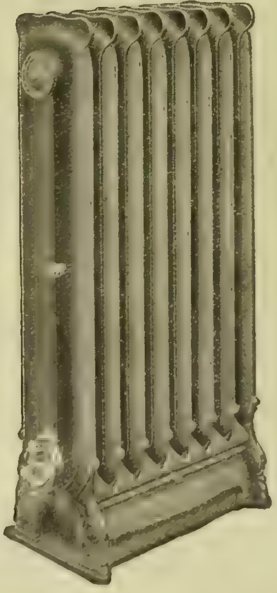
◆

Willenhall Gas Company.—At the half-yearly meeting of the Company, the Chairman (Mr. C. Tildesley, J.P.) remarked that there had been a considerable increase in the sales of gas, chiefly for manufacturing purposes. The report and accounts were adopted, and the dividends recommended were declared.

Shortage of Labour at Gas-Works.—At last Wednesday's meeting of the Stockport Town Council, Mr. S. Meunier (the Gas Engineer) submitted a letter from the Board of Trade stating that they had communicated with contractors on the subject of the supplies of coal, and had brought the engineer's representations as to shortage of labour and similar difficulties to the notice of the Labour Exchange and the Chief Industrial Commissioners' Departments. The Engineer also submitted a letter from the Minister of Munitions stating that the question of labour shortage had been brought to the attention of the Home Office Committee concerned with the supplies of coal. Regarding labour difficulties, the position of establishments supplying power, light, and heat for carrying on munition work was being dealt with in the Bill now before Parliament for amending the Munition Act.

The "MARS" Gas Heated Steam Radiators.

Supplied extensively for Heating Drill-Halls, Hospitals, Concentration Camps and Munition Works, and for other Military Purposes.



The "MARS."

WHAT MAKES THEM SO DURABLE: The Radiator Loops are assembled with malleable nipples and metal-to metal joints—making the life of Radiator uniform and absolutely lasting in character.

AUTOMATIC VALVE: Free from mechanism; simplicity itself; and infallibility as well.

MAINTENANCE: The cost of upkeep is practically *nil.*

These Radiators are quickly and cheaply installed and as easily removed, and are therefore specially suitable for heating temporary buildings.

ON HIRE WITH MANY IMPORTANT GAS UNDERTAKINGS.

ARDEN HILL & CO.,
Acme Works, Birmingham.

Bolton Town Council and a Gas Committee Minute.

At a meeting of the Bolton Town Council last Wednesday, Mr. Haythornthwaite, on the minutes of the Gas Committee, asked whether or not a certain firm was British. Mr. J. H. Crook (the Chairman of the Gas Committee), in his reply, indicated that the directors of the company referred to were British subjects, as were the shareholders, with the exception of one. There were 1500 British employees, while 100 of the staff were with the Colours. He was informed that the Government had done business with the firm. Mr. Haythornthwaite said he had a document issued from the Companies' Registration Office, London, dated 1914, which gave a summary of the share capital and shares of the company, and showed the names, addresses, and occupations of the shareholders. This indicated that there were nearly 400,000 shares in the company, almost 80,000 of which were then held by two German subjects resident in Germany, about 2000 by a German subject resident in this country; 200,000 by naturalized subjects of German origin, and nearly 100,000 by the wife and daughter of a naturalized German member of the firm. The matter was discussed at length, Mr. Driver pleading for confidence in the Government, a department of which, it had been stated, was doing business with the firm. The Chairman of the Gas Committee assured the Council that further inquiries would be made into the matter. If the concern was found to be enemy owned, immediate steps would be taken to effectively deal with the position.

◆

Grantham Gas Company.—At the half-yearly meeting of the Company last Tuesday, the Directors reported that, notwithstanding the stringent restrictions as to lighting which it had been considered necessary to enforce during the period under review, the consumption of gas still showed a moderate increase, owing to the large quantity that is now taken for heating and cooking purposes. The report was adopted, and a dividend at the rate of 5 per cent. per annum was declared.

Further Increase in Price at Pontefract.—Following on an increase three months ago in the price of gas, from 2s. 11d. to 3s. 2d. per 1000 cubic feet, the Pontefract Town Council last week unanimously agreed to a recommendation of the Gas Committee that the price be raised by a further 6d. from April 1. The Committee presented a provisional trading account showing that on the actual expenditure for the past nine months and the estimated income and expenditure for the remaining three months of the year there would be a deficit on the year's working of some £930. Mr. Holmes pointed out that last year the gas-works made a profit of £535, in 1914 of £1011, and in 1913 of £1306; and he asked why the gas consumers could not be allowed to dip into this. Alderman Pease said that the profit consisted mainly of stock and book-debts; and the Borough Accountant (Mr. H. A. Gill) pointed out that, though there was an accumulated surplus of £2875, it would be bad policy to draw out of reserves at the present time, faced as they were with the certainty of having to pay higher interest on their borrowings during the coming year.

Decreased Consumption at Scarborough.

The Directors of the Scarborough Gas Company, in their report to the shareholders on the working during the year ended Dec. 31, state that, after providing for interest charges and dividends on the preference stock, they recommend the payment of the usual dividends on the ordinary stocks for the year at the rate of 5 per cent. per annum. The sale of gas decreased by 26 per cent. compared with the previous twelve months. This is entirely due to the conditions existing in the town; and, taking into account the lighting restrictions, the absence of visitors during the season, and the large number of uninhabited houses, is less than might have been expected. An increase in the price of gas was delayed as long as possible, but could not be further postponed when the enormous advance in the cost of raw materials became known. The increase of 4d. per 1000 cubic feet was applicable to the second half of the year only, and increased the revenue by about £2000. In addition to this amount contributed by the consumers, it has been necessary to take a sum of £6708 from the reserve account, and to suspend the depreciation on cooking-stoves, &c. During the year the Company received instructions from the Ministry of Munitions to extract certain constituents from the gas, required to increase the supply of high explosives, and at once complied with the request. Already, thirty-two of the Company's employees have joined the forces, and allowances amounting to £771 have been paid to dependants. Increases in wages, to the extent of about £700 per annum, have also been granted to meet the extra cost of living.

◆

Sulphate of Ammonia Exports.—Speaking at a recent meeting of the Surrey County War Agricultural Committee, Sir Sydney Olivier (Secretary of the Board of Agriculture) said the total production of sulphate of ammonia in this country was 420,000 tons a year; and the agriculturists had never used more than one-tenth of the production, and had never in the slightest degree suffered from the exports. The spring was the only time when there was a considerable demand for it; and during the spring months its export was going to be entirely suspended. It was untrue to say that the total exports had increased.

Sunderland and South Shields Water Company.—The Sunderland and South Shields Water Company had a revenue of £119,628 from water-rents last year, as compared with £114,755 in 1914. The Directors recommend that dividends for the half year ended Dec. 31 be declared at the following rates, free of income-tax: On the ordinary and preference stocks, 4½ per cent.; on the additional capital stock (maximum dividend 7 per cent.), £3 3s. per cent.; on the additional ordinary capital stock (maximum dividend 5 per cent.), 2¼ per cent., making, with the interim dividend, a dividend for the year on the different stocks, less income-tax, of 9 per cent., £6 6s. per cent., and 4½ per cent. respectively. The works of the Company have been maintained during the year; but considerable expenditure has been deferred, owing to the war. There were 2823 yards of mains laid in 1915, making a total of 391 miles in the Company's area.

"CANNON" GAS WATER HEATERS.

A LUXURY IN ANY HOUSEHOLD.
SIMPLE! EFFICIENT! ECONOMICAL!

The "C.I.F." Circulator.

Can be attached to any existing Circulation System.

Strongly constructed with Cast-Iron Boiler and Casing.

The Casing is lagged with Sheet-Iron and insulated with Slag Wool, thus retaining and utilizing the heat to the fullest extent.

Right or Left-Hand Connection.

The 'Maelstrom' Circulator.

Constructed with strong Cast-Iron Case, with Fire-Brick Lining.

No Wrought-Iron Tubing is used in the construction of the Boiler.

There are no flue cavities, as the Boiler provides its own Flue.

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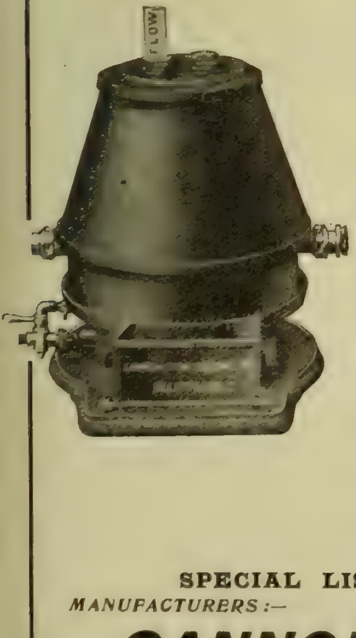

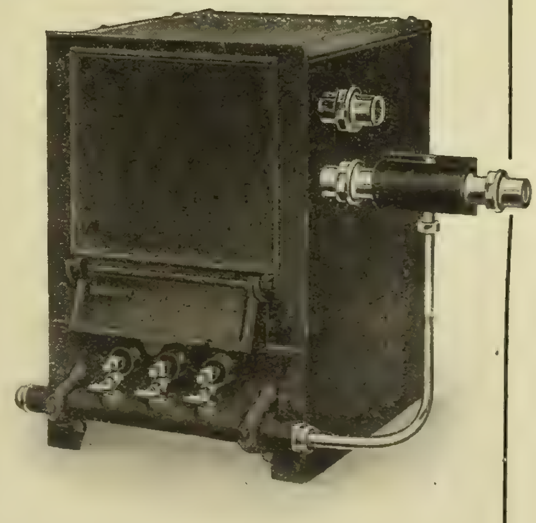

The Stockport Corporation minutes show that, at the meeting on Jan. 11, £4751 was authorized to be paid as income-tax on gas profits. The income-tax on the electricity undertaking profits was £1448.

The York Water Company have decided to make substantial reductions in charges in view of the stress of the times. At the half-yearly meeting last Thursday—Alderman Sir Joseph Sykes Rymer (the Chairman) presiding—dividends were declared of 5 per cent. on the 1876 preference shares, 3½ per cent. on the 1896 and 1900 preference shares, and 7 per cent. on the new ordinary shares.

Under the auspices of the Leeds Philosophical Society, another course of lectures on municipal undertakings has been opened; the first, on Friday last, being by Mr. C. G. Henzell, the Leeds Water Engineer, who dealt with the Ure Valley water supply scheme, and illustrated his lecture by lantern views. Mr. Henzell traced the history of the scheme, mentioning the claims of Bradford and Harrogate on the ground, and proceeded to describe the extensions being carried out by Leeds, in regard to which the city obtains a gathering-ground of 18,141 acres, representing a daily yield of over 23¼ million gallons, of which 15½ millions will be available for Leeds and 7¾ millions for compensation purposes. The work on this scheme, it was stated, is now well in hand.

The Directors of the South Staffordshire Water Company have resolved (subject to audit) to transfer £2000 to the credit of the depreciation fund, and to recommend to the proprietors the declaration of a final dividend for the year ended Dec. 31 on the ordinary stock at the rate of 6½ per cent. per annum, less income-tax (making with the interim dividend 6½ per cent., less income-tax, for the year), carrying forward a balance of £9209.

Six persons were affected by a gas escape in Bradford last week. Two children died, one of whom, however, was ill; and it is not definitely established that death was directly due to the gas. It appears that for some time there had been the smell of escaping gas in Crown Street, Sunbridge Road; but it had not been sufficient to call for report to the authorities. The family principally affected is composed of the wife and four children of Sergeant Rowan, who is at the front. As nothing was seen of the family on Friday morning, neighbours tried to gain admittance; and eventually the door was opened by Mrs. Rowan, who in a dazed manner pointed upstairs, and then collapsed. The children were rescued by the neighbours. The youngest, a baby, was dead, and the others were suffering from the gas. It was also found that a six-year-old boy next door, who was ill, had died. There had been a smell of gas and a slight explosion in that house during the night.

STOCK MARKET REPORT.

The general course of things on the Stock Exchange last week was to a great extent a repetition of its predecessor. Business was decidedly on a quiet scale, and there were intermittent periods of dulness alternating with recovery of firmness in several lines. The intelligence received from the various fields of hostilities did not amount to a moving factor; but political relations—especially those affecting the United States and Germany—were prominent. In Government securities, the War Loan and Consols were steady, although not active. It is believed that a considerable amount was placed in Exchequer Bonds and Bills which otherwise would have come into Capel Court for investment—the State being to this extent in competition with the House. The demand for Colonial issues was strong. Home Rails, in spite of dividend announcements of a satisfactory character, dragged considerably. The American Market was in poor case; the aspect in the German question being highly disquieting. Canadians suffered in consequence, notwithstanding the grand business they are and will be doing. In Foreign, the French loan went well, despite momentary checks. Japanese was uniformly strong and in good request. The £5,000,000 loan to Russia which Japan is said to be negotiating indicates her financial strength. In the Miscellaneous group, the most conspicuous was rubber, which, after a rather poor start (the sequel of the previous week's check), had a good time and finished up strong. Copper, oil, and textiles were also well supported. Among topics of interest, the report of the Montagu Committee was welcomed as a step in the right direction; but some of its features came in for criticism—the 15s. 6d. deposit scheme being widely regarded as ill-calculated to win the sympathy of the working man. On the other hand, the concession of exemption from income-tax to the small investor in Exchequer Bonds through the Post Office was well favoured. It is to be hoped that these piecemeal boons may not be arriving too late to catch the interest of the million. Business in the Gas Market was scarcely up to the measure of the preceding week in point of volume; but some issues which do not often appear were dealt in; and the general tone was quite firm. The impression created by the meeting of the Gas Light and Coke Company on Friday was favourable. In the Money Market, supplies were ample and rates were easy.

Bargains done for cash during the week were as follows: On Monday, Imperial Continental 69¾, 70, 70¼, Primitiva 45s, South Metropolitan 77, 78. On Tuesday, Imperial Continental 70¼, Primitiva 45s., South Metropolitan 77¼, 78, Tuscan debenture 80, 80½. On Wednesday, Gas Light ordinary 76, 76¼, 76⅜, 76½, 76¾, 77, ditto maximum 60, 60½, Newcastle 90½, Oriental 99, 99½, Primitiva 40s. 6d., ditto preference 3⅝, South Metropolitan 77, 78. On Thursday, Bombay 4 15/16, 5, Bournemouth "B" £11 16s., £11 17s. 6d., Commercial 4 per cent. 75¼, 75⅝, 75¾, Gas Light ordinary 76½, 77, Primitiva preference 3 11/16, South Metropolitan 77, 78. On Friday, Commercial 4 per cent. 75⅝, Gas Light ordinary 76½, 77, ditto maximum 60, 60½, Melbourne 92⅞, 94½, Primitiva preference 3 11/16, South Metropolitan 78½. On Saturday, Alliance and Dublin debenture 65 11/16, Commercial 4 per cent. 75¼, 75½, ditto debenture 56, Imperial Continental debenture 77⅞, 66, South Metropolitan 77⅞, 78.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	8 18 2	..
374,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	65 11/16
280,000	5	April 29	7½	3/-	Bombay, Ltd. . . .	5⅞—6⅜	5 17 8	4 15/16—5
60,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c. . .	29—30	5 6 8	..
378,480	10	"	7	7/-	Do. B 7 p.c. .	15—15½	4 10 4	11/16/0—11/17/6
95,000	10	"	6	6/-	Do. Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Do. Deb. . .	..	—	..
880,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
330,000	"	"	†11	55/-	Do. New . . .	204—209	5 5 3	..
50,000	"	"	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb. .	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk. .	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	75¼—75¾
560,000	"	"	5½	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	56
800,000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200,000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord. . .	98—102	4 15 6	76—77
2,600,000	"	"	3½	3½	Do. 3½ p.c. max. .	76—79	4 8 7	60—60½
4,062,235	"	"	4	4	Do. 4 p.c. Con. Pref.	96—99	4 0 10	..
4,674,850	"	June 11	3	3	Do. 3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	"	"	10	10	Do. 10 p.c. Bonds .	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C . . .	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 3 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6	69¾—70½
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	66⅛—67
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
661,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7		Do. B	146—148	4 14 7	
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	92⅞—94½
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	90½
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	99—99½
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7½—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	4 19 3	..
100,000	50	"	12	60/-	Do. C . .	118—121	4 19 2	..
52,000	50	"	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 18 4	40/6—45/-
499,960	5	June 26	5	2/6	" 5 p.c. Pref. .	4¾—5	5 0 0	3⅝—3 11/16
521,600	100	June 2	4	4	" 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	Do. 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	"	"	10	10	Do. B	222—224	4 9 3	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	77—78½
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
187,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c. .	135—138	5 8 8	..
742,275	"	"	6	6	Do. B 3½ p.c. .	115—117	5 2 7	..
181,255	"	June 26	4	4	Do. 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	1	—	Tuscan, Ltd.	5—6	3 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	80—80½
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6¼	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/8	55/1½	" C 3½ p.c.	110—115	5 2 0	..
852,000	"	"	6⅛	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	"	"	6⅜	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

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EDITORIAL NOTES.

Under Full Control—War and Statutory Regulations.

THE gas industry used to chafe under the excessive statutory restrictions which hampered its progress, and hindered it in moulding its policy and methods to the conditions which time and fresh discovery brought about. Then, largely through the work of the late Sir George Livesey and the South Metropolitan Company (to which work the present Chairman, Mr. Charles Carpenter, D.Sc., materially contributed), a greater measure of freedom was obtained, and that condition was the one that was being enjoyed at the time the hostilities began which have inverted and dislocated the whole of the world's affairs. With the war, it has been found that the statutory regulations, the supervening war conditions, and the activity of war-profit makers, have combined to fix progressively a most unreasonably heavy weight upon the heels of the industry—mostly financial—which interferes with its mobility and opportunities in doing the best possible to resist the oppression which war conditions of an inevitable sort would alone impose.

The industry has never been under so much impediment and control as at the present time; and while it has to put up with it, it does not like the position, although in so far as the conditions are the best for the country as a whole, no complaint is made. Taking the address of the Chairman at the meeting of the South Metropolitan Gas Company last Wednesday, and picking from it the points that affect the current situation, a general indication is presented without the details as to actual effect, of the nature of the impediments and control currently ruling the industry. There are the coal difficulties and high prices; but the Chairman in these respects now feels much more comfortable over them than he did before the Coal Exports Committee (the death of whose Chairman, the Right Hon. Russell Rea, M.P., we exceedingly regret) set to work, and the Price of Coal Limitation Act came into force. Then there are freights, in connection with which the Chairman does not see any signs of improvement, and he has not a good word to say for the Government as to the way in which they have handled this matter—in fact, their policy in regard to it has been "very disturbing," which, when the infinite consequences are considered, is a modest way of expressing the position. There has been a great deal of mystery over the inaction of the Government in regard to freights; and when Mr. Carpenter says that he cannot understand why they have not before this controlled transport by sea as well as by land, he is only saying what business men throughout the country are feeling and remarking—men who know how much the country has been industrially and commercially crippled by the disinclination of the Government to attack the problem of the mercantile shipping before this reached the chaotic and acute situation in which it is now, and rescue from which will be a much more difficult matter than it would have been formerly. Incidentally in this connection, the information was given, in reply to a question by a proprietor, that the Company are having five colliers built, and have been running some old ones which they acquired in order to obtain some relief from the excessive market rates of freight.

The extraordinary conditions in regard to coal and freight are the worst of the trammels; but they are not the sum of them. Restrictions have been placed by the Government upon the export of coke. There is no complaint as to this, so long as the coke is really required for home use; but, of course, the limitation of the market affects local prices and limits distribution. High freights, again, have embarrassed the industry through depriving it of its foreign market for pitch; and the annexing of the Road Board's finances (there is to be partial restoration of their contributions for road-tarring purposes) has also helped to depress the tar market. And now the Government have stopped the issue of licences for the export of sulphate of ammonia; although the producers, through their Association, were willing to reserve sufficient for home use at a relatively low price. There are labour difficulties owing to the war; the higher price of gas is a drag on normal, let alone obstructing an increase of, business; and the rightly imposed lighting restrictions are not conducive to the promotion of the best of trading circumstances. Thus, as is seen, in every direction gas undertakings are controlled or impeded in connection with their operations at a time when the largest amount of trading freedom is required to make both ends meet. All the control and all the impediments have their combined effects, measured by the increase in the price of gas, the reduction of dividend (as well as bonuses in employee co-partner companies), and in some cases the diminution of the moneys in reserve.

Speaking of the reduction of the dividend, the point was raised in our columns some time ago (and has since been referred to) as to the sliding-scale not having any provision embodied in it for extraordinary circumstances, in order to obviate excessive depreciation of dividend and market values of stock, and reduce gas companies to a worse capital-raising position than other enterprises. We are pleased to see that, in effect, Mr. Carpenter acknowledges the deficiency of the sliding-scale system in this one respect. He says: "The constitution of the Company, if I may so describe the "Acts of Parliament under which we work, was never "framed to meet war times; and there is no doubt, in my "mind, that the dividend payable does not represent an "adequate return for the risks and difficulties inseparable "from carrying on a business of this particular complexity "and magnitude, and which increase rather than diminish—"in other words, that the sliding-scale is not giving even "justice at the present juncture." This statement will also be a satisfaction to those gas men—coming as it does from the (so to speak) birthplace of the sliding-scale—who have recently been trying to move in the matter of making an effort to obtain the suspension of the sliding-scale during the war, to the extent that war conditions affect its normal operation. While sympathizing with them, we are in full agreement with Mr. Carpenter, in view of the resolve of the Government not to take up any legislative matters that can be postponed, that it is at present no use quarrelling with the position, "as certainly no remedy is possible during the "continuance of the present struggle, and we must be content to make the best of it." The form of this statement suggests that the matter will not be overlooked on some future occasion. But the Chairman proceeded to apply a little emollient by asking the proprietors, when considering how much the dividend has fallen, to remember that the consumers are also suffering by reason of the increased price charged for gas, and the employees by reason of the diminished bonus earned under the co-partnership. "The "burden has, at any rate, been shared." "Shared;" but "the sliding-scale," said the Chairman just previously, "is "not giving even justice at the present juncture." There is certainly in the current circumstances inequality in the "sharing" process regarded from the point of view of the individual proprietor and the individual consumer. The burden of the increase made in the price of gas is spread to a greater extent than the reduction of dividend. The proprietor who depends for his income upon the dividends received from his investments in gas is hit much harder than the individual consumer, especially when we consider the weight of income-tax. We do not expect, if this war ends in the manner we all hope it will do, that there will be a repetition of war on a similar colossal scale for generations, if ever. But what of amalgamations for militant purposes of powerful trade unions? What extraordinary internal troubles are we likely to have in the future? Possibilities must be considered; and we do not want gas stocks and shares to lose, under altered circumstances, their old reputation for a fair consistency of value, and for assurance as to dividends. What possible harm could be done by conferring on the Board of Trade the power to suspend the operation of the sliding-scale in respect of dividends under an exceptional set of conditions that could not fairly be said to have been in contemplation when the sliding-scale system was framed? The existence of such a power could not possibly harm anybody; but it would be an available standing protection.

A large part of the proceedings on Wednesday was taken up with the consideration of the Bill the Company are promoting for causing their financial powers to harmonize with the needs of the times. The times have changed, and so have the standards of investment, and the requirements of investors. The terms on which gas capital issues were made in the past are no longer applicable; and the inapplicability has been consolidated and accentuated by the general financial conditions created by the war. These conditions are not of an ephemeral character; they will have long continuance. But the possession of powers to issue redeemable stocks bearing high rates of interest is a protection against their existence in perpetuity, if conditions recede in manner that will allow capital to be issued upon easier terms.

Reasonableness and Air Raids.

Meddlers with things about which they know little or nothing were, during the weeks when the peace of these islands was undisturbed by nocturnal air raids, urging that, where lighting restrictions were in force, they should be relaxed. There was no ground whatever for their officious intervention. The protection of the whole community from the bombs of the German dastards was a matter that they obviously considered of minor importance to the safety of those relatively few pedestrians and wayfarers who now use the streets after nightfall. These are stay-at-home times after dark; for the attractions of the outer life have been depreciated considerably by the curtailment of the public lighting. But the vapourings of the busybodies had, and very properly, no effect upon the authorities; and the busybodies have had a salutary lesson offered to them by the experiences in the murderous raid in the Midlands and Eastern and North-Eastern counties. On this occasion it was proved conclusively that towns that were the darkest (though lying right under the track of one or other of the Zeppelins) were the safest, and escaped with little or no harm; those where the lighting had not been, or had been only slightly, dimmed—not being within an area in which the lighting restrictions were in force—suffered terribly in some cases, both by the slaughter of human beings and the destruction of property. The evidence as to this was so pronounced that there is nothing more to be said against restriction; and, in face of the terrible lessons of the raid, the local authorities and the people in the areas affected, hardly required the belated order of the Home Office extending the restrictions as to street, shop, factory, and domestic lighting to the central and north-western areas of England. Before the order was issued, many of the local authorities had already decided upon, and the residents had clamoured for, that night darkness which mystifies the cowards of the air, and defeats them in their efforts to obtain the desired measure of satisfaction from their brutal work.

But a feature of the last air raid is that it enlarges the accumulation of evidence as to the proficiency of the central authorities (to whom the country looks for foresight in this matter of protection) in becoming wide awake, after life has been lost and property has been laid to waste, to the fact that something more should have been done than has been done. The range of the Zeppelin has been known for some time; but instead of this range being taken into account, the authorities seem to have based the scope of the application of their regulations upon actual performance rather than upon capacity and possibility. So, perhaps, when the Zeppelins pass beyond the extended area to which the lighting restrictions have now been applied, authority will make another enlargement of the area. But it seems to be a condition precedent to effective steps being taken that grave mischief must be done. This applies in this matter, though very definite is the lesson of the last raid that the darkest towns are the safest. It will, however, be a pity if the local authorities adopt panic measures. There is no need to be unreasonable; but this is what the local governors of some towns decidedly are in connection with the doing of what is necessary in respect of precautions and of laying down rules as to how to act when the warning is given that Zeppelins are approaching. We are prohibited from publishing the names of towns. But there is at least one local authority who have determined since the great raid to cease altogether the lighting of the public streets. That is wrong. In other cases, it is reported, instructions have been given that, on information arriving as to the approach of air raiders, the supplies of both gas and electricity are to be cut off. This is dangerous, especially in connection with indoor lighting. Perhaps, under the new conditions of airships having become a portion of the equipment in military organization, and their use of military importance, save when employed in the hellish business of slaughtering innocent people, including women and children, it may in time become to be regarded as a military necessity that the public gas-lamps shall, in some way, have a special system to themselves, or shall be under pressure-wave or other form of control which will enable the lamps to be extinguished at a given signal, and lighted again when danger has passed.

It is not only lighting that requires to be suppressed, but church bells and chimes, works' syrens, &c. This is being done in some cases. Sound can be a guide as well as light. But we see it has been decided in more than one extensive area to use large electric-buzzers to give warning of the approach of aërial raiders. The use of electric-buzzers is all right so long as they are not employed in a way, and at a time, that will enable the raiders to gain information as to their precise location. The enemy is in our midst; and there is no question that information as to the precautions adopted, and particulars that may be of value to the raiders, find their way by, it may be, devious routes to the place from which the raids are planned.

However, our interest is chiefly centred in the precaution as to lighting; and in this respect, although restriction of lighting means reduced gas consumption, all in the industry are to-day confirmed in the view that, under the modern conditions of warfare, darkness and not light is an imperative night condition of the streets of cities, towns, and villages. But regulation need not be carried to the extreme of unreasonableness. In saying this, we shall have those who like mathematical accuracy asking us: "What is "reasonable and what is unreasonable in this matter?" They would probably like the reply expressed in foot-candles; but the only reply we are inclined to give them, and consider necessary, is that in every city, town, or other place, commonsense must be the referee and arbitrator.

The Treasury and Tar for Road Purposes.

It cannot be said that, since gas undertakings have been busy on the extraction of benzol and toluol from gas by the "C" process, they have received much encouragement from the Government; as a matter of fact, tar commercially has gone from bad to worse. Pitch has become a drug on the market, and stocks are accumulating in an embarrassing manner; and this all through freights being at rates that are prohibitive to the export of pitch. On top of this, road authorities have been economizing in their use of tar for road surfacing and making purposes; and, in the early part of last year, the Road Board began to retrench in the matter of grants for this purpose. Following, there came the announcement that the Government were going to divert—only temporarily, we believe—the current funds of the Road Board into service in directions that were, through the war, immediately pressing. This meant a further discouragement to road authorities to make good use of tar for road maintenance, without saying anything as to its employment for permanent improvement purposes.

Yet gas undertakings were faced with this position: Toluol and other constituents of tar were wanted badly and in greater and greater quantities by the Government; to obtain the largest practicable yield of toluol, the largest possible quantity of gas must be consumed. The more gas consumed, the greater the quantity of tar and pitch made; and, under the repressive conditions produced by inaction as to freights and the want of encouragement to local authorities to employ tar for road purposes, the worse off the gas undertakings in regard to this product. Furthermore, the Ministry of Munitions—quite properly—prohibited the use of crude tar on the roads; and the Road Board supported them in this. Then gas undertakings have largely adopted tar-dehydration plants, for the double purpose of facilitating and rapidly enlarging the available yield of the products the Government desire for high-explosive purposes, and of complying with the behest of the authorities as to only refined tar being used on the roads. The stock of the dehydrated tar has been increasing throughout the country; and tar distillers are not particularly solicitous about taking the partly distilled tar while they are well supplied with the crude material. And, as a matter of fact, too, some works are finding a little trouble with the tar through, after dehydration, its greater viscosity, which makes barging and emptying much more troublesome.

And in face of all this, tar is not just now a particularly good friend in respect of the fortunes of gas undertakings. In the accounts of many undertakings last year, it did not show up at all well; and the prospects were worse. However, according to a report issued last week by the Council of the Institution of Gas Engineers, the Treasury have now agreed that "a sum equal to that expended in the past year "should be devoted to the repairs of roads during 1916." The gas industry is truly thankful for small mercies; but it would be more so for yet larger consideration under the pressing circumstances. The "past year," as we have pointed out, was not one of the best for the amount of work done on the roads—in fact, it falls a long way behind the best. What the gas industry thinks would be only fair under current conditions would be that the road authorities should be encouraged to use tar up to their requirements in one of the best years, and not be limited to those of one of the leanest years—such as was the "past year."

Calorific Standards in England and America.

We have much pleasure in publishing to-day a letter from Mr. S. W. Stratton, Director of the Bureau of Standards at Washington, and may express the hope that a large number of engineers will comply with our correspondent's request for certain information regarding the fixing of calorific value standards. It will have been observed from articles that have appeared in our columns that the controlling authorities in America have had a decided leaning towards higher calorific standards than obtain in this country, while generally, though not entirely, the technical advisers of the gas companies have had a tendency towards fixing standards that approach somewhat nearer that which has been prescribed as the standard in this country, subject to any modification deemed desirable owing to local conditions. We agree with our correspondent that the problem of the selection of the proper heating value standard is primarily an economic one; and, further, that the question is to determine the amount of "useful heat" which can be made available for a given price to the consumer. We are glad to see this employment of the word "useful;" for if the mind is kept upon this term, and not upon the mere question of the quantity of B.Th.U. per cubic foot (which is subsidiary to giving the consumer something that will be most useful to him for the variety of work for which he wishes to use the gas), much light is thrown upon the problem.

This brings us to the point at which we could have wished that Mr. Stratton had entered upon a little explanation, and shown us what he personally means by "useful" heat. The amount of the "useful" heat, of course, depends (always assuming consumption to be with the most efficient appliances) upon the composition of the gas, and the quantity and intermixing of the air required for its combustion. For water heating the value of a gas may be said to be directly according to its calorific power; but for incandescent lighting it is not so. For this purpose, or any other requiring a high temperature, a gas is needed the composition of which will enable the most intimate admixture to be made between it and the air, so as to get the most perfect combustion, and the highest flame temperature possible, and this without introducing to the gas more air than is requisite, so as not to swell the volume of nitrogen, carbonic acid, and water vapour, which do not assist flame temperature, but extract heat from the flame, and carry it off in the products of combustion. The intensity of the flame itself, and not the calorific value of the gas, is the thing that matters for lighting or other purposes needing a high flame temperature. For power purposes, too, the character of the gas that will allow of the most speedy and intimate admixture with air is the most serviceable. Ethylene, propylene, and benzene are the three components of coal gas of *per se* the highest calorific value; but they are the three that require the largest quantity of air for their combustion, in comparison with the other constituents of the gas, and the more air demanded for the complete combustion of such gases, the more nitrogen, carbonic acid, and water vapour will there be trotting off through the medium of the products of combustion, with heat energy from the flame. The gases that demand the least amount of air for their perfect combustion are hydrogen and carbon monoxide, and next methane. Yet the differences between the calorific values of these gases mixed with the relatively small quantity of air needed for complete combustion and of the gases of higher individual calorific power mixed with the larger amount of air needed for their complete combustion, are very small indeed. It is significant—and this bears upon the general question—that the removal of benzol from (say) 16-candle gas to an extent which will reduce the illuminating power to about 10½ candles will only affect the calorific power by between 4 and 5 per cent. Therefore it is clear that, to obtain the best results by realizing the most intimate admixture, and by keeping to as low a level as possible the quantity of air in the mixture, and so reducing the volume of the heat-absorbing products of combustion, a rich gas cannot be the most "useful" for the consumer.

It seems that Mr. Stratton regards as a "very low" heating value the calorific standard adopted in this country—500 B.Th.U. (total heat test); and he asks whether this operates to the advantage of the consumer, or would the consumer and the gas undertaking be better cared for if the calorific quality were increased (say) by 5 or 10 per cent., with a corresponding increase in the price charged for gas. Taking into consideration the conditions of consumption and use, our reply to the first part of the question is in the affirmative; and we cannot see any compensating advantage in raising the standard. In another form, Mr. Stratton puts the position positively to the "best informed engineers" in this country. He asks: "Would you prefer to deliver "gas of (say) 5 or 10 per cent. greater heating value per "cubic foot, if you could secure for such gas an increase in "price of 5 to 10 per cent.?" The answer to this is that some of the best informed engineers in this country formerly asked Parliament for a standard of 540 B.Th.U. gross with a 7½ per cent. margin before penalties began to accrue, and latterly have been preferring a level 500 B.Th.U. standard, without the margin. Had they a preference in the direction indicated by our correspondent, they would put it into operation in their applications to Parliament. If, too, a manager considered it better for his undertaking and consumers that he should give 10 per cent. more B.Th.U. than the standard, there is nothing whatever to prevent him doing so. He can give any calorific value he likes above the standard; but he knows that it is prudent to keep the quality fairly regular. As to 10 per cent. increase in the price charged, municipal gas undertakings and maximum price companies can sell at what figure they like up to their statutorily prescribed maximum, which is always well ahead of their requirements. Sliding-scale companies, too, can increase their price (if necessary), providing they reduce their dividend. So that, if it were to the interests of consumers and undertaking, any gas management has complete liberty to augment the calorific power of the gas distributed, and, if conditions demand, advance the price at the same time. But let us look at actual figures. In normal times a very large part of the gas in this country is sold at 2s. 6d. and under per 1000 cubic feet, or (taking the bare 500 B.Th.U. standard) per 500,000 B.Th.U., or 16,666 B.Th.U. for 1d. Supposing the calorific value is increased by 10 per cent., 50,000 B.Th.U. would be added to the total. Increasing 2s. 6d. by 10 per cent. would give another 3d. Divide the 50,000 B.Th.U. by 3d., and we have still 16,666 for 1d. Supposing that 4s. 2d. is charged for 1000 cubic feet of 600 B.Th.U. gas—that is a total of 600,000 B.Th.U., or 12,000 B.Th.U. for 1d. Ten per cent. added to the 600,000 B.Th.U. would be 60,000 B.Th.U. Ten per cent. added to the 4s. 2d. would be 5d. Divide the 60,000 by five, and we have still 12,000 B.Th.U. for 1d. We fail to see where the consumer or the undertaking would, from the economic standpoint, be benefited by the additions.

We are pleased to see that the Bureau of Standards is perfectly willing to advocate a lower heating value standard than that which now prevails in the United States, "if "thereby better service to users of gas can be ensured." Investigations this side all go to show that gas of approximately 500 B.Th.U. is a gas that has good all-round usefulness for the consumers, and that, considering the variety of purposes to which it is put, there would not be, for the various reasons advanced, any economic gain to the consumers by adopting higher values. A somewhat higher value than the standard must, of course, always be supplied, in order to ensure continuous compliance, and to escape the infliction of penalties. We repeat the hope that some of our British gas engineers and chemists will comply, through the "JOURNAL," with Mr. Stratton's request for their views on the points he raises.

The Third Largest London Company.

In view of the fact that the Brentford Gas Company have recently successfully carried through amalgamations which must have had the effect of largely increasing the list of shareholders, as well as the area over which powers extend for the supply of gas, it is not surprising that last week's meeting should have been unusually well attended. The undertaking is an increasingly important one; for its latest activities have resulted, as the Chairman (Mr. R. J. Neville Neville, M.P.) pointed out, in the Brentford becoming "the third largest Company in the London area—their output coming above that of the Commercial Gas Company, and next to that of the South Metropolitan Company." And apart from these considerations, some of the proprietors may have been moved to attend the meeting by a desire to make the most of their opportunities; they having seen in the Directors' report a proposal that in future there should be only one general meeting each year, instead of the two hitherto held. This course was shown by the Chairman to possess several advantages, which were evidently thoroughly appreciated by all those present, none of whom offered the slightest opposition to the suggestion. If the proprietors do have to wait for twelve months before the Board next render an account of their stewardship, a perusal of last week's proceedings will convince them that they can do so without feeling anxiety. The small increase made in the price of gas—the first upward move for nearly a quarter-of-a-century and, referring to the rises of the Metropolitan Companies, "longer delayed than the others"—it is hoped will see the Company through the present troublous times; and the accounts reveal a first-rate position of affairs. In the past half year the additional cost of coal has been practically balanced by the extra receipts; while the heavy sum required to meet the allowances made to those on active service and for war bonus, has been secured by savings under the head of distribution. These are gratifying features; and alluding to them calls to mind the excellent record of the Company—which deservedly was the subject of a special resolution at the meeting—from a patriotic standpoint. No less than 45 per cent. of the employees have joined the Colours or been attested for service when required—which affords ample justification of a feeling of pride on the part of all concerned.

Coal and Coke District Committees.

Such a multiplicity of Committees have been called into being by the war, and through the unusual conditions to which birth has been given by it, that the outsider will have some difficulty in keeping within mind the number of such bodies who are looking, with more or less efficiency, after his and the country's interests in this time of trial and crisis. It is obvious that some of the Committees, through the immensity of the matters with which they have to deal, have to act on incomplete information; and there is consequently a fair amount of speculation underlying their decisions. If the decisions are right, so much the better; if they are wrong, there is a shrug of the shoulders, and the best possible, it is said, has been done under the circumstances, and with the knowledge available. In dealing with coal and coke, or (to use the generic term) the fuel supply question, the Board of Trade have brought into existence eleven District Coal and Coke Supplies Committees, who are to act as intelligence collectors and fuel controllers, with reference of questions beyond their functions to a Central Committee, of which Mr. W. F. Marwood, C.B., is Chairman, and whose duty it is to consider matters relating to the distribution of coal and coke. The appointment of the District Committees has been very favourably received; for it is recognized that the question of fuel supplies is more pressing in some districts than in others. They are to ascertain and keep an account of the resources of their respective districts, and see firstly that these resources are utilized to the best advantage for the requirements of important industries, especially those engaged on munition work. Gas-works and coke-oven plants, as the sources of the supply of certain high explosives, must be among the first to have consideration. Careful attention, too, will be given to any recommendation the Committees may make with the view of realizing greater economy in the use of coal. If their work is carried on in a broad and circumspect manner, the Committees should be very helpful at this time.

Distribution—by Rail and Sea.

Regarding the matter of coal and coke distribution, the Ministry of Munitions have issued a circular-letter urging upon all users the more economical employment of railway trucks, by prompt unloading and return. The waggon pooling scheme is being actively investigated by the Railway Executive Committee; but their views as to the pooling of privately owned waggons are not yet known. Voluntarily, the Great Eastern, Great Central, and Great Northern Railway Companies have come to an agreement regarding the pooling of their waggons, in the hope that this will be of public advantage. The question of freights is also occupying a large amount of attention, and will probably do so this week in prominent ways—business men being very dissatisfied with the methods pursued by the Government in the handling of this matter. Lord Curzon's Committee are busily engaged in assessing the number of ships which can be spared from the primary duties of supplying the direct military requirements of the Governments of this and allied countries. Italy particularly is in need of succour in the shape of cheaper tonnage. But, speaking generally, there is a large amount of secrecy as to what the Government are doing in connection with organizing the mercantile marine, and bringing freight rates down to a more reasonable level. Only the other day the Executive of the Unionist Business Men's Committee of the House of Commons had an interview with the President of the Board of Trade respecting the problems arising out of the control of shipping; but they appear to have been placed under a pledge of secrecy as to what Mr. Runciman had to say on that occasion. The shipowners seem to be, reluctantly, making a little concession to the pressure of public opinion. But it is a very little—that hoary headed old sinner the law of supply and demand continuing to be put forward as a satisfactory excuse for the shipowners' remarkably profitable terms. The current rates for coal from the Tyne to London are from 14s. to 15s. per ton. Why not 114s. or 115s. per ton? Or, why not, in the interests of the country, 5s., 6s., 7s., or at most 7s. 6d. per ton, when the Gas Light and Coke Company can bring with their own vessels coal from the Tyne and from Yorkshire at prices (items of expense all told) between a few pence below or above 4s. per ton? The shipowners, however, prefer two to three times more than there is any occasion to charge, so that there will be a good balance of profit for them, after satisfying the 50 per cent. excess profit tax.

The Oil Position.

While the outlook for coal is not, with all the schemes adopted to ease the situation, such a happy one as large users could wish, the oil position is not any better, what with the reduction of imports and the price. Some large producers of carburetted water gas will be very tightly pressed soon if oil conditions do not improve. The trouble is largely due to the shortage of tank steamers; the Government requirements, submarine activity, and mine "incidents," having combined to reduce the available tonnage, while the demand, instead of diminishing, for most classes of oil and spirit has increased. The augmentation of working expenses, too, has helped to enhance the price of all grades of oil. From the "Petroleum Review," it may be learned that the total shipments of petroleum products into the United Kingdom during January amounted to 32,839,390 gallons, or 9,862,199 gallons less than in December. This is a considerable difference. Of the total, 7,679,150 gallons were gas oil (Solar), 6,998,330 gallons benzine, 982,370 gallons fuel oil, and the remainder practically all illuminating and lubricating oils. However, as to the shortage of tonnage, one authority states that American shipbuilding yards are very busy on the production of additional oil-carrying steamers. But even including the tonnage under construction and afloat, the whole will be only about equal to the transport of sufficient fuel oil to displace 1 per cent. of the world's production of coal. In connection with this statement, the computation is interesting that a ton of oil when used for steam-raising purposes is about equal to 1½ tons of coal, and when used in internal combustion engines, such as the Diesel, is equal to something like 4 tons of coal.

Institution Annual Meeting.

The Council of the Institution of Gas Engineers are wise in coming to an early decision respecting the character of the annual meeting which is to be held in London, on Tuesday, June 6. There is not the remotest chance of the end of the war being reached by June; and, if there were, the end of the war is not going to witness the termination of the inglorious muddle in which the world finds itself to-day as a result of the terrible upheaval. With, too "bolts from the blue," and just when least expected, the gas engineer feels that his place is always now within easy reach of his works. Moreover, the general conditions of things do not improve; and, in the keenest of judgments, they are going to be still worse before they are given the opportunity by the declaration of peace of beginning to mend. Therefore, all things considered, the Council have taken a prudent course in again deciding upon a one-day meeting, the only prepared items for which will be the address of the President (Mr. John Young), the reports of the Council and the various Committees, and other purely formal business. Many things may happen in the (all but a week from date) four months before the meeting is held; but we are certain of this, that the resolve will be made early that nothing that can be avoided will prevent as many members as possible coming up to London to support, and do honour to, the one and only John Young who counts among them, and to chat over affairs with old professional friends.

Sulphuric Acid under Control.

In a footnote appearing on p. 244 of our issue for Feb. 1, the announcement was made that the Government had decided to "control" the makers of sulphuric acid, with the view to the regulation of prices and the securing of better distribution. The prices and difficulties associated with the obtaining of supplies was helping to wreck sulphate of ammonia production; in fact, it is stated that at certain coke-oven plants, the manufacture of sulphate of ammonia was, through these causes, already discontinued. The same troubles were operating with serious disadvantage on the whole of the chemical industry's work in which sulphuric acid is a basic necessity. The prediction of a fortnight ago has now been fulfilled; and from yesterday, as will be seen from the announcement elsewhere, maximum prices rule for the sale of sulphuric acid. Delivered into railway trucks, carts, or barges at makers' works, the maximum prices are to be: Arsenical acid (140° Twaddel), £3; dearsenical (144° Twaddel), £3 15s.; arsenical acid (168° Twaddel), £5 15s.; dearsenical acid (168° Twaddel), £6—the last two 93 to 95 per cent. sulphuric acid. Though "controlled" prices, these are enormous as compared with those preceding the war. Take dearsenical acid (144° Twaddel), to which is now attached a maximum price of £3 15s., this was procurable at (say) 30s. to 40s. before the war; whereas the average for the country lately may be taken as between £5 and £6; while in some of the outlying districts of Lancashire, prices of from £9 to £10 were known. These are ruinous figures. The Government have not moved too early in producing partial relief in the general interests of the country, though the new maximum prices are very favourable to makers, and burdensome to users, compared with pre-war ones.

Care in Contracts.

However great may be the care which councillors and officials exercise in connection with contracts entered into by their corporations or councils—and admittedly great care is exercised—it is, no doubt, well that note should be taken of a warning which is contained in a case heard a short time ago by Mr. Justice Lawrence, while presiding at the Kent Assizes. The defendants were a borough surveyor and an alderman of the Corporation he was serving under; and they admitted the offence, which it was stated had been committed without any suggestion of fraud and dishonesty. The amount involved was quite trifling; and it was not claimed that the price charged for the goods in question was above the ordinary market rate. Briefly, the facts were that the surveyor, requiring a few iron pipes to carry out a job for the Corporation, asked a firm to supply them one of the members of which was an alderman of the Corporation. The goods were supplied; and—apparently in view of the Statutes prohibiting councillors being concerned in any contract with the body of which they happen to be members—it was arranged, it is said on the proposal of the surveyor, that the account should be rendered in the name of one of the firm's clerks. Another small order followed; and the account then was made out in the name of a different clerk, who, happening to occupy a public position, saw the accounts of the Corporation, among which his own name appeared. Investigation followed; and the documents were forwarded to the Director of Public Prosecutions. It was felt to be in the general interest that a prosecution should be undertaken "for the purpose of showing that members of corporations or councils cannot, without the risk of legal proceedings, enter into trading arrangements with officials or others connected with these corporations or councils, and then sit and pass payments to themselves under assumed names." That councillors cannot legally do any such thing, they must know; the lesson of the case under notice is that the penalty for acting illegally may be severe—in this instance it was a fine of £25, and payment of one-half the cost of the prosecution. To officials—who, of course, also know the law—the lesson is that they must not, against their better judgment, allow themselves to become parties to such illegality. Doing so, cost this surveyor £5, and one-half of the expenses of the prosecution.

Certified Occupations.

In connection with the letter of Mr. W. T. Dunn to members of the Institution of Gas Engineers (which is noticed on another page of this issue), on the subject of enlistment and gas-works employees, it may be pointed out that a complete list has been issued of certified occupations under the Military Service Act, 1916; the price being one penny. It must, however, be understood that the list is not to be regarded as final. It will be subject to revision from time to time, as the industrial situation of the country may demand—occupations being added to, or withdrawn from, the list. There are a large number of occupations the work of men in which, the Government Departments concerned have certified, under section 2 of the Military Service Act, after consultation with the Army Council, is of national importance; and it is the men engaged in these occupations who, subject to the provisions as to individual certificates contained in the regulations to be issued under the Act, are exempted from the Act. Any man whose principal and usual occupation is one of those named in the list, and who wishes to be exempted from the provisions of the Act, must obtain an individual certificate of exemption by applying to the local tribunal of the place of his employment, unless he is a man who is employed in connection with coal mining—when his case will be treated in accordance with arrangements made by the Home Office. All certificates of exemption are liable to review in accordance with the Act and the regulations. A certificate held on the 1st prox. in connection with an Admiralty, War Office, or War Service badge is a certificate of exemption; and anyone holding such a certificate need not ordinarily apply for a certificate to the local tribunal on grounds connected with employment.

British Industries Fair.

The second British Industries Fair organized by the Board of Trade, with the idea of giving firms an opportunity of exhibiting goods of their own manufacture, and of bringing them into touch with both home and over-sea buyers, is to open next week. It has been arranged in consequence of the success of the previous one, which took place last May, the business transacted at which exceeded all expectations. Admission, it may be remembered, was by invitation of the Board of Trade; and the general principle was followed of restricting these invitations to *boná-fide* trade buyers. In order that it should in no way interfere with the manufacture of munitions and other Government supplies, it has been decided to confine the Fair this year to manufacturers in five separate trades, the only one of which having any particular interest for "JOURNAL" readers is glass and glassware. Last year the Fair was held in the Royal Agricultural Hall; but on this occasion all suitable buildings in London, with a single exception, were from one cause or another unavailable. The exception was a part of the buildings of the Victoria and Albert Museum; and there was the less hesitation on the part of the President of the Board of Trade in asking the sanction of the Board of Education to the holding of the Fair there because it was felt that such a proposal was in accordance with the purpose which the museum was designed to serve. As a matter of fact, the primary object of its founders was to provide models for, and otherwise to aid, the improvement of such manufactures and crafts as are associated with decorative design. Owing to the fact that many of the permanent exhibits of the museum had already been removed to places of greater safety, space was available in the museum buildings which could be temporarily adapted to the purposes the Board of Trade had in view without causing any serious inconvenience to the public or risk to the contents. The Fair will remain open from the 21st inst. until the 3rd prox.

PERSONAL.

The Royal Institution have elected Professor W. A. Bone, D.Sc., Ph.D., F.R.S., a Member.

Mr. Alwyne Meade has been appointed Manager of the Wapping works of the Commercial Gas Company.

The Society of Public Analysts and Other Analytical Chemists held their annual general meeting on the 2nd inst., when the Council for the ensuing year was elected—Dr. Harold G. Colman being appointed one of the Vice-Presidents.

At the ordinary meeting last Tuesday of the Institution of Civil Engineers it was reported that Mr. H. C. Head, the Engineer and General Manager of the Winchester Water and Gas Company, had been transferred from the class of associate members to that of member.

Mr. J. H. Elliott, the Assistant Manager at the Exmouth Gas-Works (who is leaving there to take up the position of Superintendent of the Flathouse works of the Portsea Island Gas Company), was presented last Wednesday by the staff with a silver kettle and spirit lamp, suitably inscribed. Mr. W. E. Dean (the Manager), in making the presentation, said they were all sorry to lose Mr. Elliott; and they sincerely wished him and Mrs. Elliott the best of health in the future, and every success. Mr. Elliott cordially thanked the staff for the kindness they had shown him during the fifteen months he had spent at Exmouth.

OBITUARY.

News has reached Leeds of the death in Canada of Mr. Thomas E. Searle, who was formerly the local Manager of a firm of gas-retort builders. He was seriously ill at the time of the outbreak of war, but when he recovered enlisted in the Canadian forces. He, however, contracted pneumonia, from which he has died.

Major P. D. Forrett, of the 5th Northumberland Fusiliers, has been killed in action. He was a native of Alfreton, Derbyshire, being a younger son of the late Mr. Thomas Forrett, who was for many years Manager of the local Gas Company. He was a keen Territorial, and joined the forces in the early stages of the war, receiving rapid promotion during his service in the field.

The death took place, somewhat suddenly, after a short illness, last Sunday week, of Mr. John Gandon, the Engineer and Manager of the Ottoman Gas Company's works at Smyrna, to which position he was appointed in 1890—succeeding Mr. H. W. Andrews, who then became Consulting Engineer in London to the Company. Mr. Gandon, whose death at a comparatively early age—he was in his 54th year—will be widely regretted, was on a visit to England, and died at Sydenham; the burial taking place on Thursday, in Nunhead Cemetery. After being educated at the Surrey County School, Cranleigh, he became pupil to his father, the late Mr. Charles Gandon, at the works of the then Crystal Palace District Gas Company; and was for some time at the Saltley works of the Birmingham Corporation Gas Department, subsequently becoming Manager to the Ascot District Gas Company, with whom he remained some three years. Mr. Gandon left Smyrna last March for Athens, in order to transact business from there for his Company, and to communicate with his London office; but he was unable to return to Smyrna, on account of the blockade. He therefore came to England in August, leaving the elder of his two sons, Cecil, in charge of the works at Smyrna. His younger son, Kenneth, is engaged under Mr. S. Y. Shoubridge, at the South Suburban Gas Company's works. Mr. Gandon was an associate member of the Institution of Civil Engineers. Besides the two sons, there is one daughter; and he also leaves a widow. With all of them sincere sympathy will be felt.

British Commercial Gas Association.

The measure of the activities of the British Commercial Gas Association will not be made by the size of the official report of the proceedings at the fourth annual meeting, which was held in London last October. Circumstances for which this country was in no way responsible, made it necessary, as was the case in the previous year, to confine to *agenda* within the narrowest practicable limits, and to carry through such business as had been arranged at one sitting. The "Transactions" open with the report of the General Committee; and this is followed by comments of the Technical Press. Then we come to the report of the proceedings at the meeting itself—the short address of the President (Bailie Thomas Paxton, J.P., of Glasgow), and the adoption of the report and accounts, which were submitted by Mr. F. W. Goodenough (the Chairman of the Executive). The report of the meeting is followed by several appendices. There are the long list of gas undertakings and firms who support the Association, names of publicatians in which the Association's advertisements have recently appeared, subjects upon which assistance has been rendered to members, and matters dealt with in "A Thousand-and-One Uses of Gas." From these appendices, the reader is able to form some slight idea of the amount of work that is got through by those in whose hands the administration of the affairs of the Association is placed. The final pages of the report are devoted to the accounts for the twelve months to Aug. 31 last and the constitution and rules of the Association.

THE ROAD BOARD AND TAR TREATMENT.

Treasury Grant for the Current Year.

In view of the apprehension that existed in certain quarters that the usual grant made by the Treasury to the Road Board would be restricted or entirely discontinued this year—thereby adding to the difficulties arising out of the present congestion of tar products, principally pitch—our readers will learn with satisfaction that the Secretary of the Institution of Gas Engineers has received an official intimation that the Treasury have sanctioned a similar grant this year to the Road Board to that made last year.

ENLISTMENT OF GAS-WORKS EMPLOYEES.

In a circular-letter, dated the 11th inst., sent out (on the instructions of the Council, as noted in another column) to the members of the Institution of Gas Engineers, on the subject of reserved occupations in the gas industry, Mr. Walter T. Dunn, the Secretary, says:

In the "list of occupations (reserved occupations) of cardinal importance for the maintenance of some other branches of trade or industry," issued by the Reserved Occupations Committee of the Board of Trade, "Gas-Works Service" was included, and the following note added with reference to it:

> Public Utility Services—Gas, electric light, and power corporations, water-works, tramways, and canals—Skilled men in these undertakings, if attested and classified in Section B (Army Reserve), will not be called up for actual service with the Colours unless their employer states that their services can be spared.

I am directed by the Council to inform you that the Board of Trade have now forwarded to the Institution a revised list of reserved occupations relating to Public Utility Services, in which the following exemptions appear:—

> Gas-Works.—All classes of workmen inside the works.
>
> All Industries.—Mechanics, &c. Mechanics and other similar men engaged in the maintenance and repair of plant, machinery, and tools. Carters, lorrymen, and draymen (horse or power). . . . in all trades, not engaged in collecting from, or delivering to, private houses.

GAS INSTITUTION COUNCIL MEETING.

Date Fixed for the Annual General Meeting.

A Meeting of the Council of the Institution of Gas Engineers was held at the offices, No. 39, Victoria Street, Westminster, on Monday of last week—the President (Mr. John Young, of Hull), in the chair.

Losses and New Members.

It was reported that since the last meeting the deaths had occurred of Professor Vivian B. Lewes (honorary member), Mr. John Gandon, of Smyrna, and Mr. Olaf Pihl, of Kristiana (members), and Mr. William J. Dowse, of Bradford (associate member). The sympathy of the Council was suitably expressed.

The following applications for the class of member were approved: Mr. Joseph Brettle, of Sedgley; Mr. Charles Henry Carder, of Oldbury; Mr. George Bernard Fiddes, of Leicester; Mr. Reginald George Luxon, of Launceston; and Mr. Arthur Robert Wyatt, of Seaton. Mr. George Perkins, of Hull, was approved for the class of associate member. The following were transferred from the class of associate member to member: Mr. Charles M. D. Belton, of Shrewsbury; and Mr. G. M. Gribble, of Kirkby-in-Ashfield.

Annual General Meeting.

Preliminary arrangements were considered for the annual general meeting in London; and it was decided to hold it on Tuesday, June 6. The President's address, the Council's annual report, reports of Committees, and other business, only will be taken. It was arranged that the election of officers and new members of Council shall proceed as usual.

In regard to the "Birmingham Medal," it was decided not to make the award this year.

Plumbers' and Gas Fitters' Inquiry.

A report on the result of the inquiry circular with reference to plumbers and gas-fitters which was issued by the Institution was presented; and a communication from the City and Guilds of London Institute was submitted. This indicated that they were of opinion that recent developments in the use of gas render it desirable that a gas-fitter should undergo a special training of at least three years, dealing largely with matters not connected with plumbers' work; that a proved demand has been shown to exist for specialized instruction in gas-fitting; and that for these reasons, among others, the Committee of the Institute have decided to continue their separate syllabuses and examinations in this subject.

At the request of the City and Guilds of London Institute, a proposal was considered for the revision of the syllabuses of the examinations in "Gas Supply;" and a Committee was appointed to deal with the matter. Mr. Walter Hole was unanimously nominated for re-appointment as Examiner in the subject.

Institution certificates for gas-fitters were issued to 94 candidates. [A list of these is appended by the Secretary, Mr. W. T. Dunn, to the official report of the Council meeting.]

A GRANT FOR RESEARCH.

The Committee reported that they had succeeded in obtaining a grant from the Committee of the Privy Council for Scientific and Industrial Research, in aid of the Refractory Materials Research, and that applications for assistance in regard to the researches on Ventilation and Gas Heating, and Carbonization, were under consideration.

LIFE OF GAS-METERS.

Progress was reported with reference to the inquiry on the life of gas-meters, which was considered satisfactory. It was resolved that the investigation should be continued.

ENLISTMENT OF GAS WORKERS.

A report was presented showing the action taken since the last Council meeting with regard to the enlistment of gas-works employees, including various interviews with the Board of Trade on the subject. The receipt of a revised list of reserved occupations in the gas industry was reported; and the Secretary was instructed to forward a copy to the members of the Institution.

COAL SUPPLIES.

Correspondence with the Board of Trade with regard to the maintenance of coal supplies to gas undertakings, and the assurance of their attention in cases of difficulty, was reported.

Questions relating to the operation of the Price of Coal Limitation Act were introduced; and the Coal Supplies Committee were requested to give the matter early consideration.

The Council considered the subject of the pooling of coal-waggons; but, as the matter appeared to be in abeyance, it was not deemed advisable to take any action.

TAR AND SULPHURIC ACID.

A communication was read drawing attention to the serious difficulties in which many undertakings would be placed if the use of tar for road purposes were restricted or prohibited. Information, however, was available that quite recently the Treasury had agreed that a sum equal to that expended in the past year should be devoted to the repairs of roads during 1916.

The attention of the Board of Agriculture and Ministry of Munitions was to be called to the serious shortage of sulphuric acid, and the consequent wastage of ammoniacal liquor, at a time when ammonia is so urgently required for munition purposes. These Departments were to be asked to receive a deputation.

OTHER MATTERS.

An invitation was received from the British Association Fuel Economy Committee for the appointment of a representative of the Institution on the Committee. Mr. A. E. Broadberry, Vice-President, was appointed.

The reports of the Finance Committee and of the Parliamentary Committee were presented and adopted. The former included the accounts for the year ended Dec. 31, 1915.

A request from the Engineering Association of New South Wales for an exchange of publications was acceded to.

It was reported that Mr. H. D. Madden, of Cardiff, had been appointed District Member of Council for the ensuing year to represent the Wales and Monmouthshire District Institution of Gas Engineers and Managers.

PHOTOMETRICAL NOMENCLATURE AND STANDARDS.

American Proposals.

It will be remembered that in December, 1912, a Sub-Committee of the Illuminating Engineering Society of New York, which had been appointed to deal with the question of photometrical units, presented a report in which were submitted certain definitions of photometrical quantities that it was suggested should be tentatively adopted. Since the Sub-Committee consisted of men of high scientific distinction—viz., Professor A. Blondel, Dr. A. E. Kennelly, Professor E. L. Nichols, Dr. E. B. Rosa, and Professor C. H. Sharp—its report was received with much interest; and careful consideration was given to its recommendations in Europe as well as in America. In this country a critical review of the proposed definitions was presented by Mr. A. P. Trotter, at a meeting of the Illuminating Engineering Society on May 21, 1914, and a useful and instructive discussion took place on Mr. Trotter's communication [see "JOURNAL," Vol. CXXVI., p. 577].

It was generally felt at the time that the matter was one which would have to be discussed by the National Illumination Committees of the different countries, with a view to agreement (only tentative, perhaps, in the first instance) on a number of definitions at an early congress of the International Commission on Illumination. But a few months later war broke out, and the prospect of any general international discussion or agreement on this and other scientific and technical questions is now somewhat remote. Nevertheless, the American Committee has continued its efforts to draft an acceptable set of definitions of photometric quantities, and has presented a further report which was read at the Ninth Annual Convention of the American Illuminating Engineering Society on Sept. 20-23 last year, and has been reprinted in the last issue to hand of the "Transactions" of the Society. The criticisms of the former report that were offered by Mr. Trotter and others do not appear to have influenced the Committee to make any substantial changes in their proposed definitions.

The first portion of the present report is identical with that issued in December, 1912; the definitions of all the following terms remaining unaltered—viz., Luminous Flux, the Stimulus Coefficient for Radiation and its Mean Value, Luminous Intensity, Illumination, Candle, Candle-Power, Lumen, Lux, Exposure, Brightness, Normal Brightness, Specific Luminous Radiation, Coefficient of Reflection, Coefficients of Regular and Diffuse Reflection, Primary Luminous Standard, Representative Luminous Standard, Reference Standard, Working Standard, Comparison Lamp, Test Lamp, Performance Curve, Characteristic Curve, Mean Horizontal Candle-Power, Mean Spherical Candle-Power, Mean Hemispherical Candle-Power, Mean Zonal Candle-Power, and Spherical Reduction Factor.

In accordance, however, with the report of the Committee on Progress of the American Society [see "JOURNAL," Vol. CXXXII., p. 435], the term "Lambert" has been adopted for referring to "brightness" in lumens per unit projected area. It is interpreted as the equivalent in appearance to the eye of a surface source emitting one lumen per unit area, in accordance with Lambert's cosine law. The resolution regarding the expression of output and rating of illuminants, which was adopted by the Council of the American Illuminating Engineering Society in December, 1914 [see "JOURNAL," Vol. CXXVIII., p. 741], and is reproduced in the report of the Committee on Progress already mentioned, is also now embodied in the Definitions of the Nomenclature and Standards Committee of the Society.

Other additions which have been made to the definitions since they were given in the December, 1912, report are: Horizontal Distribution Curve, Vertical Distribution Curve (both following in order the definition of Characteristic Curve), and Lamp. The definition of "Lamp," which precedes that of Primary Luminous Standard, is commendable for its brevity—being "a generic term for an artificial source of light." There have also been added a number of other recommendations and definitions relating to the employment of photometry in the practical testing of lamps, &c., and these will be read with interest by many photometric operators who may have thought that the original report of the Committee had very little bearing on every-day photometry. These additions to the report should do more to render it acceptable in circles outside the little coterie of speculative physicists than all the commendations of committees and professors. Nevertheless, as appeared from the discussion initiated by Mr. Trotter's paper in 1914, it is highly improbable that the definitions will be accepted in this country until they have undergone considerable modification and re-arrangement.

The tabular statement of "Photometric Units and Abbreviations," proposed by the Committee, which appeared in the December, 1912, report contained eight items. It has now been extended to twenty items, and is reproduced below. Many of the proposed symbols or abbreviations are scarcely likely, it appears to us, to meet with any general acceptance, as they have neither the credentials of old friends nor the stamp of incomparable appropriateness. Their publication, however, may well lead to the evolution of symbols whose fitness will make an irresistible appeal to photometrists generally.

In addition to the tabular statement of photometric units and abbreviations, the text of the definitions which have now been added to those which appeared in the earlier (1912) report is reproduced in full below.

Lambert.—The "C.G.S." unit of brightness, the brightness of a perfectly diffusing surface radiating or reflecting one lumen per square centimetre. This is equivalent to the brightness of a perfectly diffusing surface having a coefficient of reflection equal to unity and illuminated by one phot. For most purposes, the millilambert (0·001 lambert) is the preferable practical unit.

A perfectly diffusing surface emitting one lumen per square foot will have a brightness of 1 076 millilamberts.

Brightness expressed in candles per square centimetre may be reduced to lamberts by multiplying by π = 3·14.

Brightness expressed in candles per square inch may be reduced to foot-candle brightness by multiplying by the factor 144 π = 452.

Brightness expressed in candles per square inch may be reduced to lamberts by multiplying by π/6·45 = 0·4868.

In practice, no surface obeys exactly Lambert's cosine law of emission. Hence the brightness of a surface in Lamberts is, in general, not numerically equal to its specific luminous radiation in lumens per square centimetre.

Defining equations:

$$L = \frac{dF}{dS}$$

or, when uniform,

$$L = \frac{F}{S}.$$

Horizontal Distribution Curve.—A polar curve representing the luminous intensity of a lamp or lighting unit in a plane perpendicular to the axis of the unit, and with the unit at the origin.

Vertical Distribution Curve.—A polar curve representing the luminous intensity of a lamp or lighting unit in a plane passing through the axis of the unit and with the unit at the origin. Unless otherwise specified, a vertical distribution curve is assumed to be an average vertical distribution curve, such as may in many cases be obtained by rotating the unit about its axis, and measuring the average intensities at the different elevations. It is recommended that in vertical distribution curves, angles of elevation shall be counted positively from the nadir as zero to the zenith as 180°. In the case of incandescent lamps, it is assumed that the vertical distribution curve is taken with the tip downward.

Photometric Tests in which the results are stated in candle power should be made at such a distance from the source of light that the latter may be regarded as practically a point. Where tests are made in the measurement of lamps with reflectors, the results should always be given as "apparent candle power" at the distance employed, which distance should always be specifically stated. The output of all illuminants should be expressed in lumens.

Illuminants should be rated upon a lumen basis, instead of a candle-power basis.

The Specific Output of Electric Lamps should be stated in terms of lumens per watt, and the specific output of illuminants depending upon combustion should be stated in lumens per British thermal unit per hour. The use of the term "efficiency" in this connection should be discouraged.

When auxiliary devices are necessarily employed in circuit with a lamp, the input should be taken to include both that in the lamp and that in the auxiliary devices. For example, the watts lost in the ballast resistance of an arc lamp are properly chargeable to the lamp.

The Specific Consumption of an electric lamp is its watt consumption per lumen. "Watts per candle" is a term used commercially in connection with electric incandescent lamps, and denotes watts per mean horizontal candle power.

Life Tests.—Electric incandescent lamps of a given type may be assumed to operate under comparable conditions only when their lumens per watt consumed are the same. Life test results, in order to be compared, must be either conducted under or reduced to comparable conditions of operation.

In Comparing Different Luminous Sources, not only should their candle power be compared, but also their relative form, brightness, distribution of illumination, and character of light.

Lamp Accessories.—A "reflector" is an appliance the chief use of which is to redirect the luminous flux of a lamp in a desired direction or directions. A "shade" is an appliance the chief use of which is to diminish or to interrupt the flux of a lamp in certain directions where such flux is not desirable. The function of a shade is commonly combined with that of a reflector. A "globe" is an enclosing appliance of clear or diffusing material, the chief use of which is either to protect the lamp or to diffuse its light.

PHOTOMETRIC UNITS AND ABBREVIATIONS.

Photometric Quantity.	Name of Unit.	Abbreviations, Symbols, and Defining Equations.
1. Luminous flux	Lumen	F. ψ
2. Luminous intensity	Candle	$I = \frac{dF}{d\omega}, \Gamma = \frac{d\psi}{d\omega}$, cp.
3. Illumination	Phot, foot-candles, lux	$E = \frac{dF}{dS} = \frac{I}{r^2}\cos\theta.\ \beta$
4. Exposure	Phot-second	Et
5. Brightness	Apparent candles per sq. cm. Apparent candles per sq. in.	$b = \frac{dI}{dS\cos\theta}$
	Lambert	$L = \frac{dF}{dS}$
6. Normal brightness	Candles per sq. cm. Candles per sq. in.	$b_0 = \frac{dI}{dS}$
7. Specific luminous radiation	Lumens per sq. cm. Lumens per sq. in.	$E' = \pi b_0,\ \beta'$
8. Coefficient of reflection	—	$m = \frac{E'}{E}$
9. Mean spherical candle power		scp
10. Mean lower hemispherical candle power		lcp
11. Mean upper hemispherical candle power		ucp
12. Mean zonal candle power		zcp

13. 1 lumen is emitted by 0·07958 spherical cp.
14. 1 spherical candle power emits 12·57 lumens.
15. 1 lux = 1 lumen incident per square metre = 0·0001 phot = 0·1 milliphot.
16. 1 phot = 1 lumen incident per sq. cm. = 10,000 lux = 1000 milliphot.
17. 1 milliphot = 0·001 phot = 0·929 foot-candle.
18. 1 foot-candle = 1 lumen incident per square foot = 1·076 milliphot = 10·76 lux.
19. 1 lambert = 1 lumen emitted per square centimetre.
20. 1 millilambert = 0·001 lambert.

BRITISH GAS LEGISLATION UNDER AMERICAN EXAMINATION.

Special Consideration being Given to the Sliding-Scale.

THE year 1905 was an important one for the Boston Consolidated Gas Company; for certain happenings of that year, as detailed in various reports published in the "JOURNAL" during 1906, led to the application to the Company of the sliding-scale—partly, but not wholly, in the ordinary British form. The investigation made prior to its application was a very thorough one. A Special Committee appointed by the Massachusetts Legislature reported. Mr. Nathan Matthews, LL.D., also prepared a report at the request of the Company; and so did Messrs. Stevenson and Burstal at the request of the President of the Company. These reports, being the results of deliberate and unbiased studies of the sliding-scale—and mostly from outside—were interesting and instructive, and disclosed a very comprehensive range of investigation. The result of all the work then done was that the Massachusetts Legislature in 1906 adopted the sliding-scale for the Boston Company. The initial price of gas was put at 90 c.; and the standard rate of dividend at 7 per cent. It was provided that for every reduction in any year of 1 c. below the standard price, the Company might increase their dividends for the following year by one-fifth of 7 per cent. This was a one-way scale, or rather a sliding with a maximum price; the Company being prohibited from charging more than the standard price. The Act of 1906, so applying the sliding-scale to the Company, provided that, at any time after the expiration of ten years, the Board of Gas and Electric Light Commissioners should have authority, upon the petition of the Company, or the mayor of any city, or the "selectmen" of any town in which the Company are supplying gas, to lower or raise the standard price per 1000 cubic feet "to such extent as may justly be required by reason of greater or less burdens which may be imposed upon the Company by reason of improved methods in the art of manufacture, by reason of changes in the prices of material and labour, or by reason of changes in other conditions affecting the general cost of the manufacture or distribution of gas." This clause becomes operative this year; and provision has been made by the Board of Gas and Electric Light Commissioners for a further investigation of the sliding-scale system.

Meantime, we have had the pleasure of again welcoming Mr. Nathan Matthews to this country; he having been commissioned by the Boston Company to ascertain what changes, if any, had taken place since 1905 in the laws and management of English gas companies with special reference to the sliding-scale. The report resulting from this visit has just been issued in book form; and useful completion is given to it by prefacing the results of the fresh investigation with the report made by Mr. Matthews a decade ago. He must be congratulated upon the interest he has discovered in the legislative proceedings of this country during the past ten years. Those of us who live in close view of the developments and changes as they arise, and accept them, and pass on to the current fresh interests, do not perhaps measure them in their fullness as the competent man who comes from outside, and makes survey over an extended period. Therefore the interest in the fresh report.

THE MODEL CLAUSES.

There is little change in the model clauses for Mr. Matthews to chronicle. The most important alteration is the substitution of the calorific power standard for the illuminating power one. He mentions that a calorific value of 540 B.Th.U. is prescribed, and that no penalty comes into force unless the gas falls below the standard by more than 7½ per cent. It should be pointed out that the 540 B.Th.U. is with the total heat test, and further that Parliament is now allowing 500 B.Th.U. (without a margin), also with the total heat test. Regarding the statement that discounts are not permitted to exceed 10 per cent. for prompt payment and 15 per cent. for large consumption, it may be remarked that gas undertakings are not tied to these fixed percentages; but there is the alternative under which a company may allow what discount they please, "provided that every such contract entered into by the company shall be alike in terms and amount under like circumstances to all consumers." In connection with the prepayment clause, the excess of 10d. for meters and fittings is mentioned, but it should be stated that 1s. is the maximum excess if a cooker is included in the "fittings." Information is given from the last Parliamentary Returns; and noted is the progress of consolidation through the amalgamation of undertakings.

GENERAL LEGISLATIVE TENDENCIES.

Concerning the London Companies, apart from special legislation, the matter that struck the reporter most is the "marked improvement that there has been in the management and financial condition of the Gas Light and Coke Company; the price charged by the Company in 1913 being 2s. 6d. or 6d. per 1000 cubic feet less than in 1903." As to general tendencies since 1903, Mr. Matthews says the changes as to illuminating power, consumption, and prices, may be summarized as consisting of a marked inclination to substitute the calorific standard for candle power, of an increase in consumption of over 30 per cent., and of a general reduction in manufacturing costs and prices until the increase in the net cost of coal brought about by the present war.

The effect of the recent advance in the cost of coal was generally to cause a slight increase in prices during the latter half of 1914, and a large increase during the first six months of 1915.

Transition to the Sliding-Scale.

Mr. Matthews finds there has been a considerable extension of the application of the sliding-scale. Out of the 520 private authorized undertakings operating in 1912, 258, or 50 per cent. had adopted the system, and were responsible for 70 per cent. of the total amount of gas sold in the United Kingdom by the authorized private undertakings. The corresponding figures for Jan. 1, 1904, were 202, 44 per cent., and 68 per cent. Since 1912, York and Liverpool, two large maximum dividend companies—that for Liverpool being the largest in the United Kingdom—have gone over to the sliding-scale, and several smaller companies have done the same. At the present time, in Mr. Matthews' estimation, the sliding-scale companies must furnish about 75 per cent. of the aggregate amount of gas sold by the authorized companies. The *per capita* consumption of gas in England and Wales in 1912 was 5444 cubic feet. In 1913, and the first half of 1914, gas was being sold, as a rule, at prices lower than those obtaining in 1903 or 1905. This, Mr. Matthews remarks, was made possible by the increase in sales, and by the lowering of the requirements as to illuminating power and purity; and he might have added by a general improvement in administration, and by the change from the high-temperature carbonization of coal in light charges to the high-temperature carbonization of heavier charges over a greater number of hours—resulting in higher makes per ton, and less depreciation of the quality of the gas and other products.

Protection of Sliding-Scale Conditions.

A matter of considerable importance to the Boston Company at this particular time is the fact that Mr. Matthews is able to report as to the disinclination of Parliament to alter the prescribed figures in the sliding-scale as applied to any company if it is likely to interfere with the dividend sanctioned by the legislature, and which constitutes the basis of sale of new stock or shares under the auction clauses. Admittedly, there have been changes in the standard prices of sliding-scale companies; but "no case has been discovered in which the company did not secure some special consideration or equivalent for the reduction in their standard price, nor any case in which the reduction was sufficient to cause any diminution in the rate of dividend paid." The power to enforce a reduction in the standard price when fresh privileges are sought and granted, is exercised by Parliament with much restraint. Out of more than 300 Acts passed since 1876 extending to sliding-scale companies additional privileges by way of capital or consolidation powers, or in the form of some reduction of the standard of illuminating power, a decrease in the standard price has been insisted on in only 26 cases—less than 10 per cent.

Increased Sales with Lower Average Capital.

A peculiarly interesting section of the report is the one showing how, although capitalization has considerably increased during the past ten years, this has not had correspondence with the increase in the sales of gas—thus resulting in a lower average capital per 1000 cubic feet of gas sold. Figures are furnished for 27 English companies, who in 1912 were selling 500 million cubic feet or more of gas, which show this trend of capital in relation to business done by comparing 1903 with 1912.

—	1903.	1912.	Inc. or Dec.
			Per Cent.
Fourteen sliding-scale companies—			
Corrected capital*	£26,782,188	£30,127,109	Inc. = 12·4
Sales, millions of cubic feet . .	45,772·1	63,145·7	Inc. = 38·0
Capital per 1000 cubic feet sold .	11s. 8d.	9s. 6d.	Dec. = 18·5 [2s. 2d.]
Thirteen maximum dividend companies—			
Corrected capital*	£7,475,555	£8,398,482	Inc. = 12·3
Sales, millions of cubic feet . .	14,712·4	19,774·8	Inc. = 34·4
Capital per 1000 cubic feet sold .	10s. 2d.	8s. 6d.	Dec. = 16·5 [1s. 8d.]

* Outstanding share capital (less amounts nominally added by conversion), premiums received, and loans issued.

The figures for the large companies which appear in "Field's Analysis" are as follows

—	1903.	1912.	1914.
Corrected capital*	£30,574,221	£34,551,854	£35,501,033
Sales in million cubic feet . . .	55,091·3	71,220·2	74,208·5
Capital per 1000 cubic feet sold .	11s. 2d.	9s. 8d.	9s. 6d.

* Outstanding share capital (less amounts nominally added by conversion), premiums received, and loans issued.

The same trend of affairs is shown in this table—considerably increased sales, with diminished capital expenditure per 1000 cubic feet of gas sold.

Interest and Dividends.

Another table shows the aggregate amount paid for interest and dividends by the companies which figure in "Field's Analysis" (omitting the Alliance and Dublin Company):

—	1903.	1912.	1914.
Corrected capital	£30,574,221	£34,551,854	£35,501,033
Sales in million cubic feet . . .	55,091·3	71,220·2	74,208·5
Paid for interest and dividends* .	£2,271,932	£2,606,714	£2,665,324
Per cent. of capital	7·43 p.c.	7·54 p.c.	7·50 p.c.
Per 1000 cubic feet sold	9·8d.	8·6d.	8·4d.

* Including the amount, if any, carried by the sliding-scale companies to the reserve fund, and by the Gas Light and Coke Company, in 1912 and 1914, to the redemption fund.

The reporter states that it is hardly necessary to point out that, owing to the operation of the auction clauses, these are nominal rates only, and that the actual return to the investor is in the neighbourhood of 4 per cent. This, of course, is on loan and ordinary capital combined. If the ordinary capital alone were taken, it would be nearer the mark to say that "in the neighbourhood of 5 per cent."—somewhat under and somewhat over—has been in normal times the yield per cent. on the investment, as can be seen by our stock and share list at the end of June, 1914. By those who are studying British conditions, too, it should be noted that, in view of the rates of interest on the last War Loan and on the present issue of Exchequer Bonds, enterprises such as gas undertakings will not—anyway, for some time—be able to raise money on anything like the same terms as they have done in the past. The reporter observes that in the modernized form of the auction clauses, the prohibition against issuing stocks at below par is omitted; but, it should be noted, the prohibition is only annulled by individual applications to Parliament. The current auction clauses have not general application till they are specifically adopted in Special Acts.

Depreciation and Increased Stability.

It is remarked that stock conversions continue in favour; and the introduction of the special purposes fund is mentioned. The "purposes" it covers are stated; but manifestly its chief attraction in the eyes of Mr. Matthews is on account of the assistance it renders to depreciation.* He finds that the result of the change in the law respecting depreciation has been to strengthen the position of the companies having regard to the relation between the capital and assets. He also observes that gas companies throughout the United Kingdom have in the last ten years been giving, more generally and fully, attention to "wear and tear." The effect of these changes in law and practice upon the Gas Light and Coke Company has been conspicuous; the outstanding share (unconverted), loan, and premium capital per 1000 cubic feet sold having been reduced from 13s. 6d. in 1903 to 11s. 4d. in 1914. Some of the larger companies, it is found, have succeeded in reducing the ratio of capital to sales by about 15 per cent. on the average. But, of course, these reductions cannot be attributed solely to attention to depreciation—the increased production per ton of coal carbonized, and the better utilization of plant through daylight consumption, and other improved conditions of business are factors of some account. However, the various depreciation funds carried by the few large companies mentioned in "Field's Analysis" have increased in the aggregate from £398,919 in 1903 to £714,053 in 1914—an increase of 79 per cent. Mr. Matthews repeats that the English companies are undoubtedly in a sounder position at the present time than they were in 1905.

Conclusions as to the Sliding-Scale.

The report proceeds to give additional information, showing the drift of opinion in favour of the sliding-scale, as attested by the number of concerns that have adopted it, and the interest shown by local authorities in furthering the change. On the experience in Great Britain, it is held that any scheme of official revision, whether occasional or periodic, is inherently inconsistent with the theory of the sliding-scale. There is a great deal more information as to the operation of the sliding-scale; and, in his conclusions, Mr. Matthews attributes a large part of the prosperity of the British gas industry to the system. Although the rate of price reduction during the period has not been much greater for the sliding-scale than for the maximum dividend companies, this he considers is a matter of relatively small concern, not only because of the considerations already noted, but owing to the fact that a period of increased costs and prices has now set in for all the companies. Upon all other points, the arguments for the sliding-scale are stronger than ever. The increase in service as measured by sales, the relations between the companies and their employees and consumers, the attitude of the local authorities, the position of the Board of Trade and of Parliament, the views of professional gas managers, the changes from the one system to the other, the number of companies under the sliding-scale, the business done by them, and "the complete cessation of any demand for public ownership" (later on the qualification is found "except in the case of the smaller plants")—these are all matters concerning which the sliding-scale companies occupy, with reference to the maximum dividend companies, a position of advantage greater even than was visible in 1905. In Mr. Matthews' view, a satisfactory system of gas company regulation should aim to secure six main advantages for the public: (1) Low price of gas; (2) progressive management; (3) extensions of service and sales; (4) harmony between company and employees; (5) satisfaction on the part of the consumers; and (6) a fair, permanent, and easily understood basis for the relation between prices and profits. He finds, as the result of his further investigation, that, as between the maximum dividend companies and the sliding-scale companies, the balance of advantage in respect of price has been with the latter—not only in absolute figures, but as to the time when reductions are made. In respect of management, service, and the relations between the company and employees, the advantage is wholly with the progressive methods engendered by the sliding-scale. And the system is the only one yet invented which attempts successfully to regulate profits upon the basis of a just and fair division between company and consumers. There is no disposition in any quarter to change a system which, after forty years of constantly increasing use, has so completely proved its possession of these advantages.

MUNICIPAL OWNERSHIP.

In another place, reverting to the question as to the transfer of ownership from companies to municipal authorities, it is stated that, since the adoption of the sliding-scale in 1876, only about twenty companies working on this plan have been acquired by local authorities. Nine of these were taken over in the year of the adoption of the sliding-scale or the year after; and only about a dozen after operation under the sliding-scale—these latter plants being all of small concerns, selling on the average not more than 10 million cubic feet per annum. Of the fifteen municipal plants selling over 100 million cubic feet in 1903 which had been bought by the corporations from maximum dividend companies, four were taken over before 1880, ten between 1880 and 1890, and only one since—in 1901. There has, therefore, been only one large company taken over by a public authority in the past twenty-five years; and no sliding-scale companies at any time except concerns of very small size. In short, at the present time, there seems to be no demand whatever for the municipal exploitation of gas-works. The sliding-scale appears to have been accepted by the public authorities as a complete and preferable substitute.

WHAT OF BOSTON?

All this being the representation of the excellent position found by Mr. Matthews of matters in Great Britain in relation to the sliding-scale and an increased statutory liberty to gas undertakings, it would now be interesting to British gas men to have presented to them an account of the decade's sliding-scale experiences, under American conditions, of the Boston Consolidated Gas Company.

ELECTRICITY SUPPLY MEMORANDA.

PRIOR to the war, some of the manufacturers of electrical plant in this country did not have a particularly rosy time. Certain of them paid their debenture interest and preference dividend; but it was a fine distinction to be able to pay dividends on the ordinary shares. One reason for this was the tight grasp that German and Austrian manufacturers had attained on the British market, and the crippling influence that their methods had on the business expansion of genuine British firms.

Coming into Their Own.

It is necessary to say "genuine" when referring to "British" electrical firms; for some of those sailing under British designations are so permeated with Teutonic capital and influences that they have no real title to be brought into any category labelled "British." The impediments to the export from Germany and Austria of electrical goods have been of great advantage to British manufacturing firms. This is pointed out in a review of the year which appears in the last issue of "The Times Engineering Supplement." Imports stopped, there had to be complete reliance for requirements upon the producing firms in this country. Then another advantage to the manufacturers has been that, though the Treasury and the Local Government Board have maintained an effective veto over capital expenditure for electrical plant and accessories where they could be dispensed with without injuring the output of war materials, there has been (so we gather from the article in question) more than adjustment of this, from the manufacturers' point of view, by the needs for lighting and motors in numerous establishments devoted to munitions work. We are afraid that, if it is all as painted, the low-profit earning "British" electrical firms (whatever be their composition) of pre-war days will not be happy in having a very careful scrutiny and assessment made of their so-called excess war profits, and in pouring into the Exchequer 50 per cent. of them. This will be, for those British concerns that have had a comparatively miserable existence through the operations of enemy firms, anything but an enjoyable parting with profits after the succession of lean years; but if the balance assists in providing some ordinary dividends, they will have occasion to remember the war in view of this, for them, exceptional occurrence. The article says that "it is satisfactory to be able to record that the industry has risen to the occasion, and that, in spite of difficulties in connection with the shortage of labour and materials, the efforts made have had an appreciable effect in increasing the output of war materials." We should have thought that it might have gone without saying that the electrical industry had risen to the occasion. Having such an exceptional opportunity, the industry would have been mad not to have made the most of it.

War and Other Experiences of the Year.

The article also gave information as to the outstanding features of the year in connection with electricity supply. The manufacturers of plant are not the only people that have benefited in the electrical industry; the supply undertakings have done so as well. The extensions made to existing engineering establishments, and the large numbers of new works that have been built, have created a demand on public supply stations for additional current for both power and lighting which was beyond the capacity of the existing plants. In all the great manufacturing centres, it is stated—Glasgow, Sheffield, Birmingham, Newcastle, Manchester, Leeds, Bristol, and elsewhere—the demand for current has been, and remains, on a scale considerably above normal. To meet this need, temporary supply stations have in some cases been put in service, and in others supplementary generating sets have had to be installed. But an interesting development has taken place in London. It is a much-talked-of project; but it has been long in taking even partial practical shape. The war has hastened it—the "it" being the interlinking scheme of the various electricity supply systems, so that stations blessed with surplus energy-producing capacity would be able to assist those on which the demand for current reached a maximum intensity. Some amount of difficulty, we are told in the article, arose owing to the varying voltages and periodicities of the systems. Nevertheless, progress has been made with the intercommunication work. Battersea, Hammersmith, and Fulham led the way in the linking-up of their stations; and later Shoreditch, Stepney, Hackney, and Poplar became allies, as well as Woolwich and the South Metropolitan Electric Supply Company. Probably further movement will be made in this direction; but there seems some hesitation in forfeiting any part of the complete independence of an undertaking, or in taking the first step on the high road to consolidation.

Progress in Intrinsic Brilliancy.

The "Illuminating Engineer" for January contained the paper that Professor J. T. Morris recently read, before the Illuminating Engineering Society, on "Recent Developments in Electric Incandescent Lamps," with special reference to the changes these have compelled in the methods of utilization. This was the occasion, too, on which the new Edison-Swan tungsten "arc-incandescent" lamp, to which reference was made in the "Memoranda" a few weeks since, was first exhibited. This lamp is, in the matter of intrinsic brilliancy, another product of electrical frightfulness. The manufacturers of electric-lamps, in their search for improvement, are diligent in obtaining greater light efficiency in relation to the expenditure of current, and simultaneously greater efficiency in the work of eye destruction. The more thoughtful ones in this connection see a red light, and are concerned lest the development of intrinsic brilliancy with progress in light efficiency should act disadvantageously to the electricity supply industry. The advances that have been made in intrinsic brilliancy are shown by this table from Professor Morris's paper:

Intrinsic Brilliancy of Electric Incandescent Lamps.

Lamps.	Candle Power or Watts.	Volts.	Watts per Candle Power.	Intrinsic Brilliancy (C.P./Sq In.).
Carbon	50 c.p.	100	3·5	381
,, ...	50 c.p.	200	4·0	420
Nernst	66 c.p.	95	1·8	2,150
Osmium	32 c.p.	55	1·9	520
Tungsten . . .	60 w.	—	—	—
Drawn wire . . .	54·5 c.p.	100	1·1	1,030
,, ,, . . .	60 w.	—	—	—
,, ,, . . .	52 c.p.	200	1·15	1,095
"Half-watt" . .	360 w.	80	0·67	5,000
,, . .	1490 w.	240	0·58	5,250
Tungsten "arc incandescent . .	100 c.p.	50 (?)	0·65	12,900

The table is worth very careful study. The rapid increase shown in intrinsic brilliancy with progress in light efficiency (the intrinsic brilliancy ascribed by Professor Morris to the misnamed "half-watt" lamp, with gas-filled bulbs, is 5000 candles per square inch!) has necessitated changes in the use of the lamps. Concealment of such filaments is imperatively necessary—at least in the view of electrical men with any conscience in regard to the matter. The coming into use, too, of these lamps means a larger recourse to indirect and semi-indirect methods of lighting, with the consequent depreciation in the amount of useful light available in relation to current consumption. Owing to the variety in the forms of filaments of electric incandescent lamps born within the last ten years, great discretion has to be exercised in making a right choice of shades and reflectors in order to maintain the efficiency as high as possible in the direction where the light is most required.

Unreliability of Low "Half-Watt" Units.

There was great jubilation in some electrical quarters recently, and less in others, over the advent of lower units of gas-filled "half-watt" lamps; but experience with them is not exactly of a satisfactory order. Nothing has been said about this in the general electrical press; but certain members of the Illuminating Engineering Society are not in the habit of hiding acute faults—their mission in life being to find means of counteracting them. In the discussion on Professor Morris's paper, Mr. A. Cunnington (London and South-Western Railway Company) made this remark: "With 'half-watt' lamps, one could not afford to look upon cost of current as the only thing of importance. Maintenance was a very serious matter when each lamp cost a sovereign; and, in order to guard against the loss of a lamp through a temporary rise in voltage, it appeared to be worth while actually to under-run slightly, even if the maximum efficiency was not obtained." Then Mr. Leon Gaster piously expressed the hope "that manufacturers would exercise restraint, and not unduly push forward with the low candle-power high-voltage units until an adequate life was obtainable. In his experience, the life of these units was less satisfactory than that of the larger units." In Professor Morris's view: "Unless experience shows that a reasonable length of life can be expected from half-watt lamps, the result in the long-run will be far from proving a commercial success, owing to the high cost of lamp renewals." Insistence on the need for restraint on the part of manufacturers is also made in an editorial in the "Illuminating Engineer."

Heating Admissions. Mr. George Wilkinson, of Harrogate, is not one of those perfervid short-visioned electrical engineers who cannot see good in anything but the particular commodity in which they are professionally interested. He has been reading a paper before the Leeds Association of Engineers, on the question of fuel economy; and, in the course of it he acknowledged that gas-fires confer a benefit by decreasing the amount of smoke and soot discharged into the atmosphere, and, by thus tending to economy, preserving the bye-products of coal. But he has no hope that householders will altogether abandon the open fire; and so he advocates slow-combustion grates, but only as a means of supplementary heating. These grates should, in his opinion, merely be used in cold weather—the primary source of heat for the house being furnished by hot water radiators supplied by slow-combustion stoves burning cheap fuel, such as coke. However, in time, the use of the open fire will be abandoned altogether; supplemental heating in the living rooms being obtained by the use of electric or gas fires. Labour-saving and convenience, in our opinion, will in time altogether annihilate the existing predominant preference for the open fire. However, notwithstanding the occasional wordy confidence expressed in the future of the electric "fire," the "Electrical Times" doubts whether householders will ever give up the open coal fire; and it asserts that "neither gas nor electric fires offer a completely satisfactory alternative—at least in the living rooms." "Ultimately, perhaps, electricity will become the main heating agent in residential property; but we do not believe that the open coal fire, in spite of the dirt and the labour it involves, will ever be superseded in living rooms, although its value may lie chiefly in its cheerful appearance." The word that we admire most in this confession is "perhaps."

Power Schemes. In his third lecture on "Fuel Economy" at the Royal Institution, Professor W. A. Bone, as was seen in the "JOURNAL" last week, had something to say about the advantages, given suitable conditions, to be obtained in the way of cheap power production by the co-operation of power users with a properly organized electric power company operating over a large industrial area. He asserted that probably no other European country is so well adapted as our own for such co-operative schemes, because of the compactness of our great industrial areas, the density of their population, and their proximity to the coal-fields. We may take it that, when Professor Bone says "given suitable conditions," and then proceeds to take the North-East Coast power scheme as an illustration, he adopts it as being the standard of "suitable conditions." If so, then other areas in the country will not stand an equally good chance; for the north-east one is the *ne plus ultra* of "suitably" conditioned areas. If the history of large area electric power schemes in this country is examined, it will be found that commercial successes are rare, and that the results of the work have been heart-breaking all along for the promoters. But Professor Bone is on fuel economy; and he finds that the surplus gas of coke-oven and blast-furnace plants is not being put to the best use; and this is supplemented by an amount of waste heat and exhaust steam. Incapacity to utilize these sources of energy and indifference account for considerable loss. Here, then, is the chance for co-operation between producers and those requiring power to form companies for turning all this into electrical energy. It seems to us (as has been the case of the Yorkshire Company) that this is a matter for existing power companies; inasmuch as it is hardly likely that, where power companies have already statutory powers, Parliament would grant fresh ones to new companies. The North-East Coast Company, who use waste gases under boilers for the production of steam, which is employed in steam-turbines (acknowledged to be the most economical power producers so far invented for large unit working), are described in the lecture as a "splendid example" of what may be achieved in this way. "In short, the scheme is a triumph of engineering skill, commercial enterprise, and scientific organization, which probably cannot be matched in any other area in the world." We agree, in view of the incomparability of the area.

REPAIRING A DAMAGED GASHOLDER.

By K. MARTENS, Manager of the Skiens (Norway) Gas-Works.

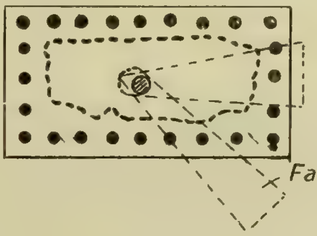
A COUPLE of months ago a gasholder belonging to the Skiens Gas Company was damaged by careless blasting operations on a new line of railway running about 300 yards from the works. Having noticed in the "JOURNAL" for June 29 last, an article dealing with the repair of a damaged gasholder in Flanders, the author has prepared a short account of the mode of repairing his own holder, which possibly may interest readers.

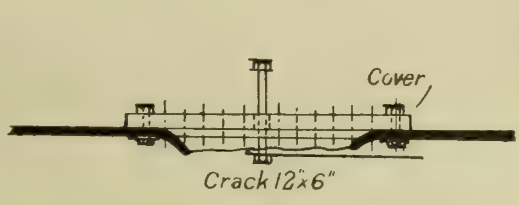
Well, then, during the blasting operations referred to a rather heavy stone was flung right on the top of the holder, which has a capacity of some 30,000 cubic feet. The force of the impact made a rent in one of the sheets, about 12-inch by 6-inch—the stone rebounding and sliding off the top to the curb, where it remained. The noise and the alarming sinking of the holder at once brought out the men, and one of them got on the top, where he sat down on the rent until some plank ends and a couple of sacks could be rammed in the rent.

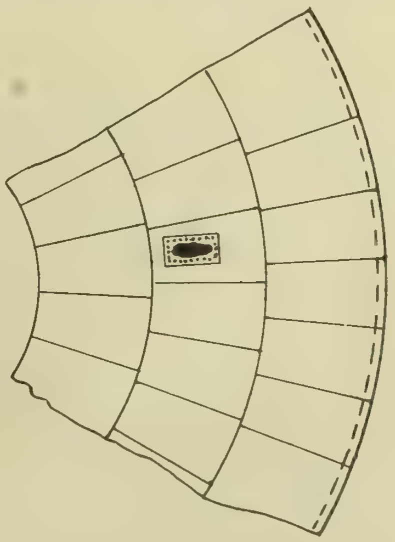
Then a cover was made of ¼ inch plate, and holes were drilled along the edges for the bolts. These holes were then marked off on the holder plating and drilled through. Wooden pegs were put in to stop the gas from escaping as the drilling went on. To insert the bolts from underneath, the hole had to be uncovered, and an arm inserted to push up the bolts. While this lasted, the gas was kept back by a piece of soft leather fastened round the arm and held down round the edges by the other men. To avoid opening the hole for each bolt, the bolts were hung down the hole, fastened like beads on a string, so that the man working could take one after another. When all the bolts had been pushed in, they were held up by a piece of string run round them on the outside. The arm was then taken away, and the cover plate carefully laid on. It was the work of a few seconds only to get each bolt to slide into its hole; and as soon as the plate had settled down on the red-lead packing, the nuts were put on, and the screwing-down could begin. The bent-down edges of the plating had to be drawn up in position—hence the washers underneath and the great thickness of the cover compared with the top plate itself.

The idea with the fan shown in the sketches was to help push the bolts upwards. It was really hardly needed, and had, of course, finally to be dropped into the tank—a screw plug closing up the hole where the bolt had been.

The job was finished in a few hours after making the cover plate ready and sending for the bolts. The loss of gas was only about 9000 cubic feet; and the accident did not in the slightest interfere with the town supply.







Slotted holes were not used; because it would have taken a longer time to make them; and the use of washers no doubt rendered it easier to pull up the bent-down edges.

OTTO DIRECT RECOVERY COKE-OVEN PLANT

INSTALLED AT TEAMS, COUNTY DURHAM.

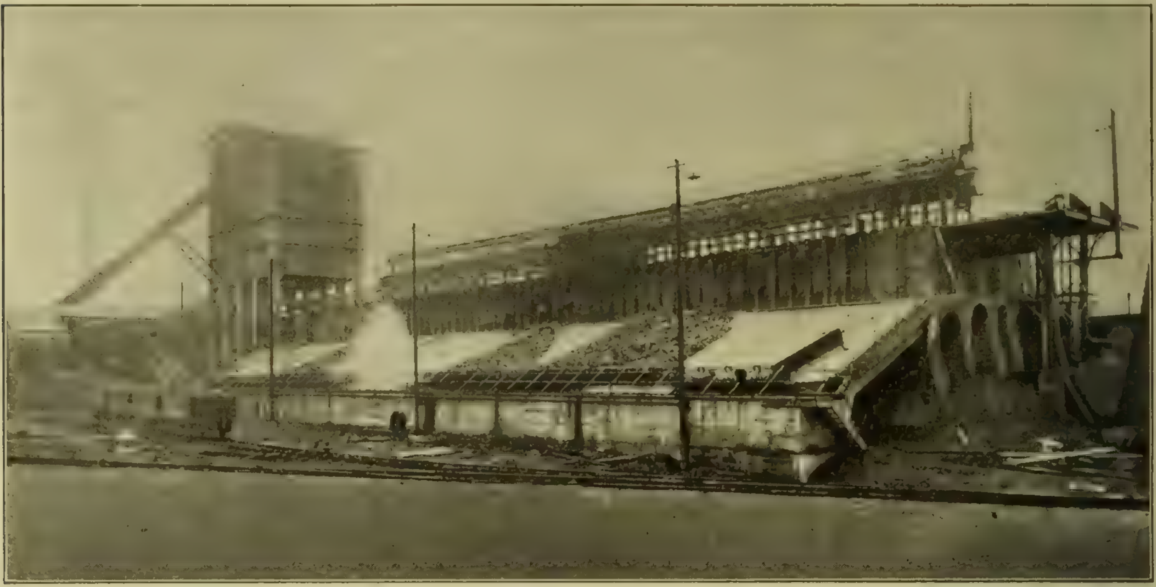


FIG. 1.—BACK VIEW OF BATTERY OF OVENS, SHOWING COAL-BUNKERS AND THE SLOPING BENCH ON WHICH THE DISCHARGED COKE IS QUENCHED.

The accompanying photographs are of the Otto direct-recovery coke-oven plant that was recently put into operation at Teams (co. Durham), which was described by Professor William A. Bone, D.Sc., Ph.D., F.R.S., in his second Royal Institution lecture on the "Utilization of Energy from Coal," delivered on the 27th ult. [*ante*, pp. 253-56]. It was pointed out by Professor Bone that this is one of the most up-to-date plants, and that upon its design and installation very great chemical and engineering experience has

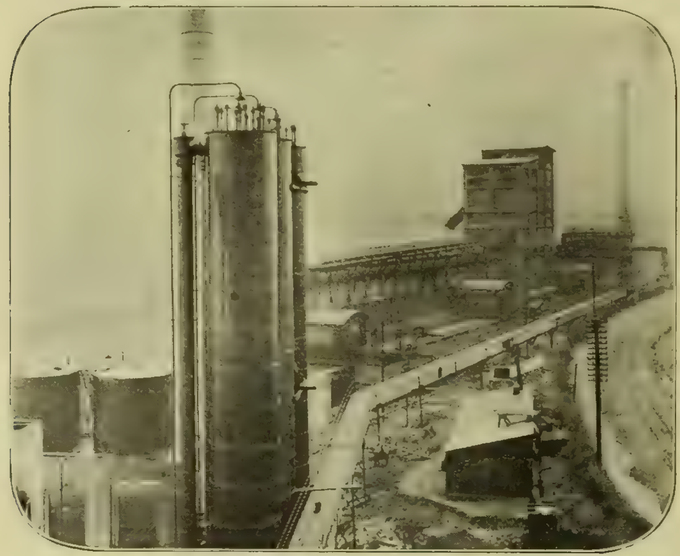


Fig. 2.—General View, showing Coal-Bunkers, Two Batteries of Ovens, with Electric Discharging Rams, and Benzol Tower Scrubbers.

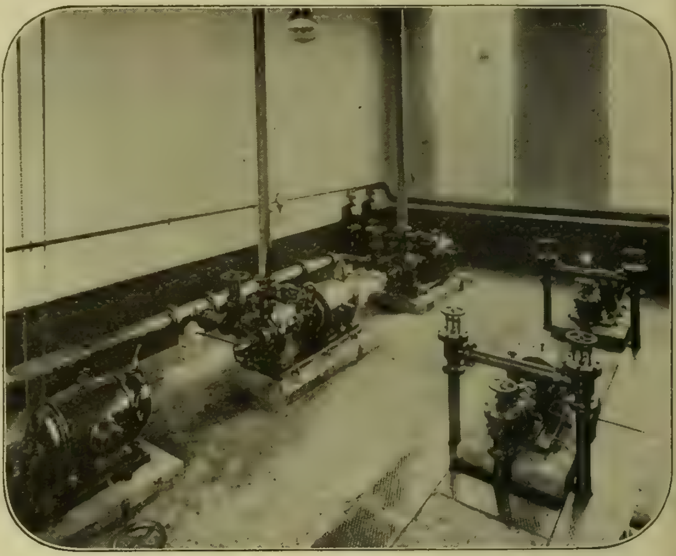


Fig. 3.—Interior of Pump-House, showing Pumps for forcing Hot Tar under Pressure into the Tar-Extractor.

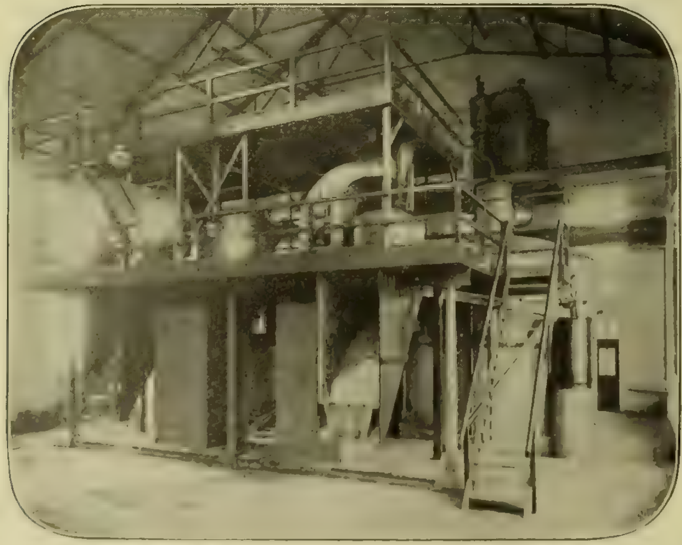


Fig. 4.—Interior of Sulphate-House, showing the Saturator in the Background, and the Arrangement for Discharging the Ammonium Sulphate from the Centrifugal Dryer.

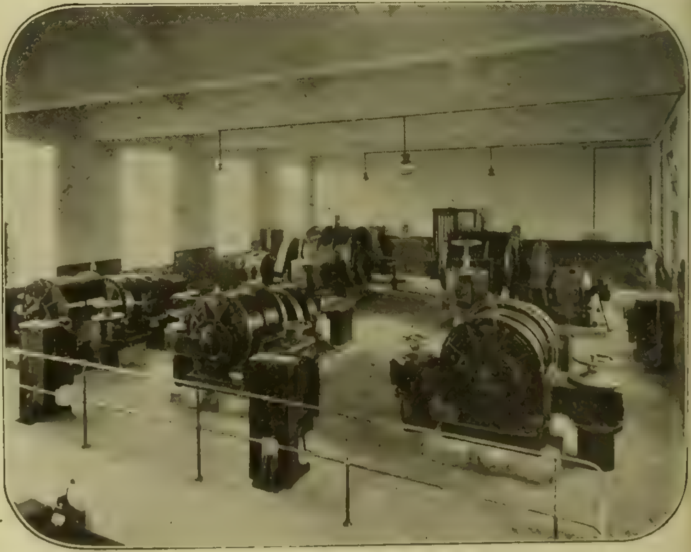


Fig. 5.—Interior of Exhauster House.

been expended. There are two batteries of sixty ovens each; the ovens being about 30 feet long, 7 feet high, and 20 inches wide. The crushed coal is charged into the oven through openings in the crown, from small hoppers which carry it on rails from the storage bunkers. When carbonization is concluded, the coke is discharged by electrically driven rams on to a sloping bench, and quenched with water. The hot crude gas, after passing through the hydraulic main, traverses in succession a long horizontal pipe and an atmospheric cooler. It then goes to the tar-extractor, where it is met by a large volume of hot tar and liquor forced in under pressure. The gas, freed from tar, passes into the saturator, where the ammonia combines with hot dilute sulphuric acid, forming ammonium sulphate. The sulphate passes through a receiver (where it is separated from any liquor), and then through a centrifugal dryer; while the gas goes on to the bottom of the naphthalene extractor and spray cooling tower. After this the gas is drawn through an exhauster, then through a second water-cooler (where the last traces of naphthalene are deposited), and afterwards to the benzol tower scrubbers, where it is washed with an oil which removes the benzol by a process of simple solution. On leaving the scrubbers, about one-half the debenzolized gas is returned to the ovens and used for heating purposes. The crude benzol removed from the gas is subsequently rectified in another portion of the plant.

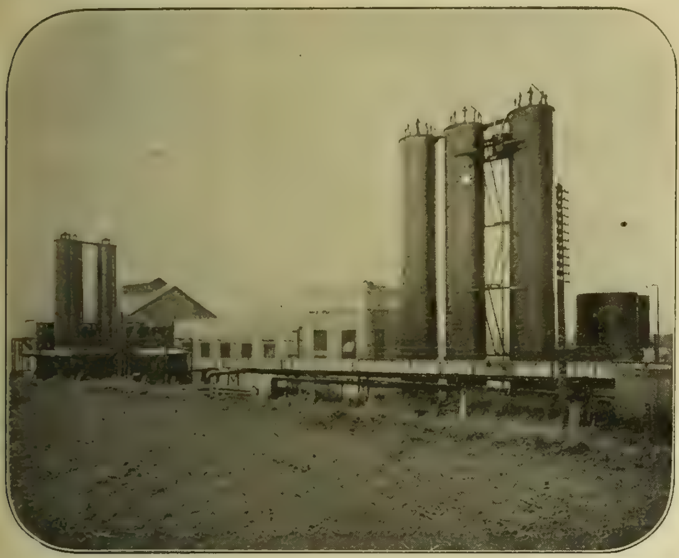


Fig. 6.—View of Naphthalene and Benzol Scrubbers.

THE GAS UNDERTAKING REGARDED AS A LOCAL AND A NATIONAL ASSET.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S., &c.

Although the old-time discontent and opposition to the gas company has long since died away, we occasionally meet with it in the person of some influential member of the local authority, who, presumably, should possess a fairly accurate knowledge of the financial and other conditions governing joint-stock enterprise, and indeed poses before his supporters as an expert on such subjects, but who nevertheless chooses to regard the parliamentary powers, dividends, &c., as valuable items of public property that have been unjustly appropriated by a body of private individuals, who have not offered or given any adequate equivalent in return. He seldom loses an opportunity of quoting the "monopoly" as something in the direction of an imposition. Even the more reasonable part of the public, who are free from political or party prejudice, or from a desire to acquire cheap notoriety by assuming the character of a guardian of the general interests, are better acquainted with the benefits secured to the gas undertaking, than with the other side of the shield. One of the useful objects so well and efficiently served by the British Commercial Gas Association might certainly take the form of some enlightenment on this matter.

If we look through the statements of account as periodically presented to the shareholders in a gas undertaking, we immediately perceive that the bulk of the expenditure, both as regards capital and revenue, is not only confined to our own country, but that a large proportion—probably not less than half—goes to the district in which the gas-works happen to be situated. The coal, iron, and fire-brick are all British products, in respect to which the enemy cannot by any possibility get a share of the trade without our knowledge. Only a few comparatively trifling accessories—such as mantles, glass, &c.—can be traced to a foreign source; and it is safe to say that these items of expenditure, small as they are, will assume more insignificant proportions in future. A prominent feature is the important share of the total outlay that is handed through the wages office pay window every week, of which nearly the whole is promptly expended in the immediate neighbourhood. A large number of shopkeepers depend upon the gas-works for the bulk of their trade; the aggregate of the wages, in the course of a year, may amount to anything between 20 per cent. and 30 per cent. of the total outlay; the buildings, gasholder tanks, and such like, will be handed to the care of a local contractor, provided a capable firm is to be met with; and the main-laying throughout the district to be supplied is dependent upon local labour.

The assessment of the gas undertaking is an important item on the ratable valuation list; and the fact that the collector's demand notes amount to 5, 6, or even 7 per cent. of the gross income, and that frequently as much as 30 per cent. of the actual profit goes to the relief of the local rates, should especially be more widely known and appreciated in the district, as it is difficult to find any other manufacturing industry that is "touched" in this respect to anything approaching an equal proportion. In the course of a presidential address delivered to the Institution of Gas Engineers in 1907 [see the "Transactions" for that year, p. 56] Mr. Charles Hunt quoted a list of about two dozen ordinary ratepayers, showing their annual turnover or gross income, their annual payments to the rate collectors, and the ratio between the two items. About half of them are below 1 per cent., and only five exceed 2 per cent. Gas undertakings can therefore claim that they pay in threefold proportion, as compared with the average ratepayer.

Sometimes a contention is advanced to the effect that an excessive assessment on the gas undertaking is nothing more than fair, as being in the nature of a *quid pro quo* for the privileges peculiar to the monopoly, or to the use of the public highways. But there is nothing in the nature of a monopoly of the roads. The gas undertaking accepts the full responsibility, and pays the full cost of any damage caused, or repairs necessitated, by their operations; and the value of the monopoly is considered in connection with numerous obligations and restrictions in respect to price, quality, supply, pressure, purity, and profits.

The dividends distributed to the shareholders are for the most part spent in the district, or, if this is not the case, the blame cannot be laid at the door of the gas company. Local capitalists, small or large, have only themselves to thank if they do not avail themselves of the opportunity of obtaining a sound, excellent home investment, that the law of the land has placed within their reach by means of the "Auction Clauses" that are invariably attached to the regulations governing the issue of new capital. In the ordinary way, a large number of gas-works' employees, users of gas, retired tradesmen, and others having funds to invest, are glad to take up securities of this nature.

The author claims to have shown that a very appreciable part of the gross income received by the gas undertaking is returned to the district where it is raised, in the form of wages or salaries, several other items of expenditure, rates, and profits, and that the concern is in no sense a financial vampire, taking a large sum of money out of the district, and affording no benefit in return.

That the gas undertaking occupies a very important position, regarded as a national asset, is strikingly evidenced by events during the last eighteen months. In the first place, it has provided men excellently fitted for military service. The keen and discriminating eye of the recruiting sergeant has not failed to notice, and appreciate the value of, the sturdy specimens of humanity that are to be seen passing through the gas-works' entrance gates, at the meal hours, or the time for changing the retort-house shifts—men whose habitual arduous physical exertion, regular exposure to wide extremes of temperature and to all conditions of weather, punctual attendance to duty at fixed hours, and strict obedience to established rules have eminently fitted for active military service under widely varying conditions of climate. The Gas Light and Coke Company head the long list with the very respectable figure of 2600; and, with few exceptions, every gas-works in the country has furnished an adequate number of men, frequently amounting to 30 per cent. and upwards of the total number on the pay sheet.

Accounts of the award of the V.C. and other high military honours to men who left the gas-works at their country's call that appear weekly in the columns of the "Journal" go to prove that the quality is as good as the quantity. Engineers, managers, and others holding responsible positions as the heads of departments, men possessing a high degree of technical training and experience in the control of large numbers of workmen, have formed a valuable acquisition to the ranks of commissioned officers and to the more skilled branches of the military service, such as engineering, signalling, &c. If the entire population of the country had followed the lead of the gas industry, there would be no difficulty in meeting the fullest requirements of Lord Kitchener, or necessity for discussing conscription and other drastic measures for raising recruits; while the ladies of the "White Feather" persuasion would find little scope for the exercise of their activities.

As regards the sin of national waste, due to the consumption of coal in the raw state, now being so eloquently and forcibly advocated by Professor W. A. Bone, the gas industry can enter a plea of "not guilty" in respect to the 20 per cent. of the total quantity of coal raised, that finds a sepulchre in the gas-works retort. A large quantity of ammonia, benzol, phenol, sulphur, and toluol are secured, together with other products that at ordinary times are valuable market commodities (necessitating the employment of considerable numbers of workers of various grades, including some of a high order), but at the present time are indispensable to the successful conduct of modern war. Also some 50 per cent.

of the weight of the coal carbonized is returned to the market in the form of coke—a fuel that practically displaces and sets free for other uses its own weight of coal. One can scarcely give an accurate idea of the further large quantity of coal that is displaced by the extensive use of gas for cooking, warming, and other fuel purposes. As in the example above cited, the coal is not lost to the community; but when the gas undertaking takes with one hand, it gives back with the other.

The financial assistance afforded by the investment of reserves of accumulated profits in war loan funds, and the income-tax paid on the full amount of profit earned, whether divided or not, is a valuable national asset; and the columns of the "JOURNAL" abound with details of the multifarious ways in which gas is assisting the production of munitions and other sinews of war, and meeting the requirements of temporary camps, hospitals, &c. To use the stock phrase of the day, gas undertakings and the gas industry are effectively "doing their bit."

FUEL VALUES.

By Dr. J. H. PATERSON.

[Extracts from a Paper read before the Newcastle Section of the Society of Chemical Industry.]

The last issue of the "Journal of the Society of Chemical Industry" contains the text of a paper read on Dec. 15 dealing with the financial value to the consumer of various fuels—coal, coke, producer gas, oil fuel, coal gas, and powdered coal.

The author pointed out that this value must be measured by the amount of heat to be obtained by the expenditure of a definite amount of money, which is totally distinct from, and is not affected by, the quantity of the available heat which is utilized in any given process. In the paper, therefore, no cognizance is taken of the methods and appliances used to obtain the most efficient utilization of the heat generated, but only the amounts of heat actually available from the fuel used.

In dealing with fuels of different classes, some difficulty was met with in finding a common unit of value for their comparison; and it was considered best, for the purposes of the paper, to make this unit the number of heat units (B.Th.U.) obtainable for 1d., after all the costs of handling the fuel and causing it to burn had been added to the price per ton. This number is referred to hereafter as the "absolute heat value" of the fuel in question.

As the cost of fuels varies considerably in different parts of the country, the comparison of their values is impossible unless the prices of all the different classes considered are those ruling in the same locality. For the purpose of the paper, therefore, the prices given were an average of those ruling in the North-East Coast industrial centres. As the present cost of fuels is in all cases abnormally high, and in some cases (foundry coke and oil fuel) out of all proportion to the usual value, pre-war prices and values are shown in the most important cases as well as the present prices and values.

COAL.

It is, the author points out, very generally recognized that the less money one pays for coal the more incombustible matter (water and ash) it is liable to contain. But it is by no means so generally realized that the absolute heat value increases rapidly as the price decreases. Table I., which is compiled from the average analysis of a few selected coals of types in common use, shows this clearly. In the table the calorific values are the net values—that is, the calorimeter value as determined on the dried coal, less the amount of heat carried away as latent heat, during combustion, by the steam produced. The price of the coal as quoted includes the cost of delivery into the works; this cost averaging about 2s. per ton.

TABLE I.

Class of Coal.	Price per Ton.	Net Calorific Value. B.Th.U.	Incombustible Matter. Per Cent.	B.Th.U. for 1d.	A.H.V.
1 Best screened loco. coal	23s.	14,280	5·6	115,000	98,700
2 Screened steam coal	18s. 3d.	13,120	13·35	134,200	110,700
3 Screened steam coal	18s.	13,260	10·65	137,500	113,300
4 Smith's small coal	18s. 6d.	13,600	10·32	137,000	115,500
5 Unscreened steam coal	17s. 6d.	13,135	12·25	140,000	114,400
6 Washed small coal	15s.	12,780	12·50	153,500	126,100
7 Heap coal	8s.	10,040	29·3	222,000	136,200

The author introduces a curve plotted to show the heat units per ton for a large number of coals against the price paid per ton. The curve is remarkably regular; and from it it is evident that (for prices between 14s. 6d. and 18s. per ton) if the coals were sold on a regular calorific scale, instead of following the laws of supply and demand, one would expect to pay less than the present market value between the limit of prices named. The coals in this area of price included unscreened steam coals, washed slacks, and small nuts, all of which are among the most commonly used classes in large works. A similar curve constructed by the author at the end of 1913 shows the falling off in value that occurs between the prices of 8s. 9d. and 11s. 9d.

Tables II. and III. show how the absolute heat values of coals Nos. 2 and 7 in Table I. are arrived at. The figures given are those obtained when these coals are used to heat a frame-bending furnace and are very similar for a hand-fired boiler.

TABLE II.—*Coal No. 2.*

One ton of coal has a net calorific value of 29,344,000 B.Th.U.

Coal at 18s. 3d.	219d.
Firing labour	36
Moving coals and clinker	8
Repairs to grates	2
	265d.

A.H.V.=110,700.

TABLE III.—*Coal No. 7.*

One ton of coal has a net calorific value of 22,489,000 B.Th.U.

Coal at 8s.	96d.
Firing labour	38
Moving coal and clinker	20
Repairs to grates	4·5
Steam for blowing	6·5
	165·0d.

A.H.V. = 136,200.

COKE.

Coke of all classes requires a blast of air to keep it burning at a high temperature; so that, in determining its absolute heat value, the cost of this blast must be included. Foundry coke has recently reached so abnormal a price that its heat value as shown is misinforming. Its value in 1913—see Table VIII.—gives a better idea as to its true relative position. Coke breeze (coke refuse from gas-works) is not, the author says, always appreciated at its true value. The breeze when screened through a screen of ¼-inch mesh loses 40 per cent. by weight of fine dust, and leaves a residue of coke nuts which is an excellent fuel for many purposes. Previous to the war it paid to throw away the 40 per cent. of dust; but now that its price has risen, it becomes worth while to briquette it and mix the briquettes with the screened breeze—the cost of briquetting being 5s. per ton of screenings, including labour and tar binder, and also interest on capital.

Tables IV., V., and VI. show how the absolute heat values of foundry coke, screened breeze, and the mixture of screened breeze and briquettes are obtained. In Table V. the screenings from the breeze are assumed to be worthless and thrown away.

TABLE IV.—*Foundry Coke.*

One ton of coke has a net calorific value of 30,350,000 B.Th.U.

Coke at 32s.	384d.
Firing labour	36
Moving coke and clinker	9
Repairs to grates	2·5
Blowing	3·5
	435·0d.

A.H.V. = 70,000.

TABLE V.—*Coke Breeze (Screened).*

One ton of breeze has a net calorific value of 29,120,000 B.Th.U.

Breeze at 10s.	120d.
Cost of screening	13
Moving coal and clinker	9
Firing labour	36
Repairs to grates	3
Blowing	4
	185d.

A.H.V. = 157,400.

TABLE VI.—*Coke Breeze (Briquetted).*

One ton of breeze has a net calorific value of 29,120,000 B.Th.U.

Breeze at 6s.	72d.
Briquetting 40 per cent.	24
Firing labour	36
Moving coal and clinker	9
Repairs to grates	3
Blowing	3
	147d.

A.H.V. = 200,000.

PRODUCER GAS.

The absolute heat value of producer gas depends mainly on the first cost of the coal and on the efficiency of the type of producer used. The results recorded were obtained from a battery of water-sealed producers of the Duff type, each producer being capable of gasifying 10 tons of coal per 24 hours. The coal used in them was the small coal No. 6 in Table I.

A cubic foot of the cold producer gas has a net calorific value of 170 B.Th.U.; and 65 cubic feet of cold gas is produced per pound of coal, or 145,600 cubic feet per ton. One ton of coal therefore gives cold gas equivalent to 24,750,000 B.Th.U. When, however, the gas is used hot (as from the producer) the sensible heat of the gas raises this quantity to 27,000,000 B.Th.U. As the original heat value of the coal was 28,627,000 B.Th.U., this shows a loss in the producer of 5 per cent. of the available heat. The absolute heat value is arrived at as shown in Table VII.

TABLE VII.—*Producer Gas.*

One ton of coal produces gas with a net calorific value of 24,750,000 B.Th.U.

Coal at 15s.	180d.
Labour	37
Steam	13
Moving coal and clinker	8
Repair and upkeep	2
Interest on capital	6
	246d.

A.H.V. of cold gas = 100,600.
" hot gas = 110,660, or 10 per cent. more.

It may be argued that a somewhat expensive coal has been chosen when calculating this absolute heat value, and that if a cheaper coal were burned in the producer, the values shown would be greater. Experience shows, however, that this is not the case, as with the stationary type of producer there is a limit to the ash content of the coal, beyond which good results are impossible. As an example, in the same producers a small dusty coal was tried with the following results: The cost of the coal was 11s. per ton, and its heat value 26,150,000 B.Th.U. net per ton. The loss in the producer was 12 per cent., and the heat value of the cold gas per ton of coal 23,000,000 B.Th.U. net. The cost of working the producer, supplying steam, and repairs to the plant amounted to 112·5d. The absolute heat value of the cold gas was 98,500, and of the hot gas 108,500. The heat value is therefore 2 per cent. less than with the dearer coal; and the dissatisfaction among the firemen being taken into account, it will be seen that the cheap coal does not by any means produce cheap gas. Mechanical producers do away with the labour and other troubles enumerated; but, owing to their comparatively short life, increased first cost, and increased upkeep, their advantages are not very obvious—in the Newcastle district at any rate.

Oil Fuel.

Within the last twelve months the cost of fuel oil of moderately good grade has increased by nearly 100 per cent. This therefore puts an always expensive fuel almost out of consideration. Good Texas oil of about 1000 seconds viscosity has a net calorific value of about 17,300 B.Th.U. per pound, or 38,750,000 B.Th.U. per ton. This oil now costs 105s. per ton. Before it can be burned in a furnace, it must be first atomized, either by compressed air or steam, or else blown through a special nozzle at high pressure into a forced-draught furnace. The cost of vaporizing oil by compressed air is 10s. per ton of oil, and by steam or high-pressure feed 6s. per ton. The absolute heat value is, therefore, obtained as follows: One ton of oil at 105s., 1260d.; steam, 72d.; handling oil, 8d.; interest on capital, 1·5d.; total, 1341·5d. Thus the absolute heat value is 29,000.

Coal Gas.

Ordinary town gas averages about 510 B.Th.U. net per cubic foot. It may be obtained at about 1s. 7d. per 1000 cubic feet in most large centres. As there is no labour or upkeep of plant to consider, unless compressed air is used, the absolute heat value works out at 27,000.

Powdered Coal.

Within recent years a method of burning coal by grinding it to a fine powder and blowing the powder into the combustion chamber by means of a stream of hot air, has received considerable attention. In the cement-making industry its application has been highly satisfactory, and its use has resulted in great economies. As applied to boiler and metal furnace firing it has, however, met with little success—owing partly to want of experience in its use, and partly to the cost of grinding and handling the powdered coal. Its absolute heat value when determined for coal (No. 6 in Table I.) is as follows: Cost of coal, 180d.; cost of grinding and blowing in the coal, 46d.; labour, 30d.; repairs to plant and renewals, 4·5d.; interest on capital, 6d.; total, 266·5d. Hence the absolute heat value is 107,300.

The Fuels Contrasted.

Table No. VIII. shows the absolute heat values of all the fuels considered, tabulated in their present order of magnitude. It should not be imagined that the figures will determine the most economical fuel to use in any given operation, as it is possible to utilize in some cases more of the available heat from one fuel than from another. Thus, by employing producer gas for furnace-heating, it is possible to use efficient regenerators, and thus recover a large proportion of the heat usually passed up the chimneys.

Table VIII.

Fuel.	Absolute Heat Value.	
	1915.	1913.
Coke breeze and briquettes	200,000	215,700
Coke breeze (screened)	157,400	232,900
Pit heap coal	136,000	140,000
Washed small coal	126,000	175,000
Screened steam coal	110,700	161,000
Producer gas (hot)	110,660	160,000
Coal powder	107,300	..
Foundry coke	70,000	140,600
Oil fuel	29,000	41,000
Town gas	27,000	30,000

As the saving in heat thus made possible is sometimes very great, the difference in the heat values of producer gas and small coal may be so far overcome as to make it economical to use the former. Again, while coal gas is shown to be highly uneconomical, it may be used for small operations with the utmost success, as the time and trouble saved in starting-up (say) a tool-hardening furnace heated by gas, more than counterbalances the increased cost of the fuel.

The Manchester District Institution of Gas Engineers will hold their annual meeting on Saturday of next week, when Mr. E. A. Harman will deliver his Presidential Address, and Mr. Henry Simmonds, of Bury, will read a paper on "Naphthalene."

PILOT FLAME IGNITION OF INCANDESCENT GAS-LAMPS.

By C. W. Jordan.

[A Paper read before the American Illuminating Society.]

The subject of pilot flame ignition of incandescent gas-lamps may appear to many to be rather a minor or unimportant detail of the broad general subject of gas lighting; and yet, on analysis, it will be found to be extremely vital for the successful operation of lamps in practice.

Convenience in gas lighting has become a necessity; and many devices have been perfected for securing automatic ignition—in some cases controlled from distant points. Despite the ingenuity shown in the design and mechanical construction of these devices, for one reason or another they have not recommended themselves as competent to meet the practical requirements of service. Those which are apparently satisfactory automatically actuate a mechanism, turning on the main gas supply, which, in turn, is ignited by means of a pilot-flame. Therefore the convenience of such mechanical devices is dependent not only upon their own merits, but also upon that of the pilot.

Other devices, which do not use pilots, while ingenious, well constructed, and positive in action, owing to their high initial cost do not find wide application.

Pyrophoric igniters, self-lighting mantles, &c., are not extensively used, because of the ease with which the mechanical parts get out of order, or on account of the short life of the active material. The simple pilot bye-pass and gas-cock actuated by pulling a chain meet the demand for convenience, economy, and service in the most satisfactory manner.

This paper, therefore, will be devoted to telling the history of the use and improvement of this simple means of ignition, which depends upon the same energy or fuel that supplies the lamp itself, and which is operated by the same mechanical movement that controls the lamp. Every consideration points to this as the ideal as well as commonsense method of ignition, if it can be perfected.

Pilot Bye-Passes.

The term pilot bye-pass may be defined as a device by means of which a supply of gas is regulated and led from a point just ahead of the gas-cock of a lamp to a pilot-tip or point of discharge conveniently placed near the mantle.

The gas-cock and pilot take-off are in some cases of separate construction from the lamp and easily detachable, while in others they constitute a true part of the lamp construction. The length of the pilot-flame is regulated by turning a small screw which moves in or out of a constriction in the passageway leading to the pilot-tip. In some instances, lamps are equipped with so-called "flash pilots." A flash pilot may be defined as one in which the pilot momentarily elongates during ignition and shoots across the top of, or into, one or more mantles of the lamp.

The means for successfully accomplishing this are several. In one lamp a secondary cock is connected to the primary gas-cock so that, upon pulling the chain to light the lamp, it is turned 180°, and the gas passes through to the pilot-tip at unrestricted pressure—bye-passing the ordinary regulating screw. Another device consists of an additional passageway bored in the gas-cock, which on being turned on supplies gas at unrestricted pressure through a small tube—bye-passing the regulating screw. When the cock is turned on full, the passageway in the gas-cock is no longer opposite the passageway leading around the regulating screw; and the gas to the pilot is supplied only through the usual regulating screw.

Flash pilots are effective, especially in arc lamps, in that they secure more positive and softer ignition of all the mantles.

Pilot Tips.

Little trouble has been experienced in constructing efficient means for regulating and conveying the pilot gas supply to the point of discharge; but the construction of a satisfactory pilot-tip, especially for inverted lamps, has been very difficult. The main troubles encountered are: (1) Carbon formation; (2) clogging of the tip, due to disintegration of the gas, &c.; (3) the ease of extinguishing the flame by draughts.

With upright lamps a plain metal tube of small diameter, placed properly in a vertical position, burns satisfactorily; but the flame is easily extinguished if the lamp is subjected to excessive draughts. A centre pilot was then designed, which consists, briefly, of placing the pilot-flame directly above, and in the centre of, the burner cap gauze—thus utilizing the mantle as a means of effectively protecting the flame from draught. The construction of a centre pilot bye-pass is shown in fig. 1 (p. 362).

With inverted lamps it was necessary to use pilot tips made of lava or other refractory material, in order to overcome the common troubles before mentioned. Lava pilot tips have undergone decided changes, both in the principle upon which they operate and in design. The first type consisted of a simple passage, drilled through the tube, and having a side outlet for discharging a luminous flame horizontally. A pilot-tip was then developed which gives a blue bunsen flame while burning. The gas discharges horizontally through a small orifice into a mixing tube provided with two air inlets. When operating at normal consumptions—between 0·1 and 0·15 cubic foot per hour—a perfect bunsen flame is obtained, which is extinguished by draught with far greater difficulty than the luminous flame pilot, and has the additional advantage of eliminating troublesome carbon formation or smoky flame. Changing the position of the primary air inlets from a vertical to a horizontal position was found to render the pilot appreciably more resistant to draughts.

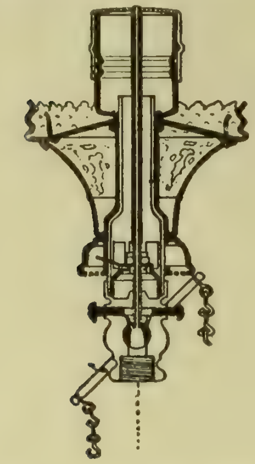


Fig. 1.—Centre-Pilot Burner.

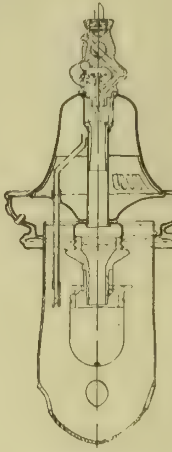


Fig. 2.—Vertical Pilot Tip.

In the early development of the bunsen flame pilot, a series of unlooked-for defects was found, a description of which may be of interest. In order to obtain a true bunsen flame, it is necessary to make the orifice of very small diameter, 0·016 inch (0·40 mm.). After several hundred hours burning of the lamp, the orifices invariably become clogged. The tips were made of natural lava, baked, and on the interior a hard glossy coating of carbon, resembling flaked graphite, was found. This extended through the entire passageway to the orifice, which, on account of its small diameter, first became stopped. An investigation was made, and it was found that the decomposition of the hydrocarbons in the gas to carbon was influenced not only by the high local temperature (620° C. at the orifice), but also by the physical properties of the substance used in construction. By using a tip made of finely crushed natural lava, repressed and baked, the trouble was practically eliminated. A small amount of carbon formed in the passageways which was greyish, instead of black, and after the lamps were burned several thousand hours was found not to give trouble.

An interesting series of experiments was made, the results of which clearly illustrate the influence of the physical and chemical properties of the pilot-tip material upon the decomposition of the gas. Various substances were placed in a transparent quartz tube, through which illuminating gas was passed, and heated slowly and uniformly by means of an electric furnace. Certain substances, like metallic oxides (particularly mantle ash), became covered with carbon at a temperature as low as 260° C.; while others (like glass, quartz, &c.) only darkened at a temperature of above 650° C.

A still more recent change has occurred both in the design of pilot tips and in the position in which they burn. The pilot-tip of the lamp shown in fig. 2 is mounted vertically; and in this position the flame is very well protected from draughts, and at the same time is positive in its ignition of the mantle.

The advantages of this type of tip are: (1) There is no orifice which may become clogged with carbon from the decomposition of gas; (2) in case the pilot-flame becomes over-adjusted, there is no danger of cracking the enclosing glass cylinder; (3) when subjected to excessive draught the pilot flame retreats within the pilot-tip and is effectively protected.

SERVICE TROUBLES.

Pilot devices are subject to numerous troubles in service. In certain localities the methods of manufacturing and purifying gas are liable to change suddenly from normal; and often tar particles are carried in suspension by the gas for considerable distances from the works. In this event the tar rapidly accumulates on the pilot adjusting needles of the lamps and completely closes the minute annular opening through which the gas discharges.

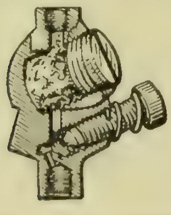


Fig. 3.—Tar Scrubber.

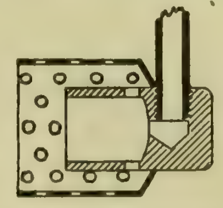


Fig. 4.—Semi-Bunsen Protected Pilot.

In order to overcome this trouble a purifying device, shown in fig. 3, was designed. Essentially it consists of passing the gas through a small cylindrical brass tube which has been packed with asbestos wool, glass wool, mineral wool, or other suitable material. The gas to the pilot-flame is completely detarred by this method for a long period. When the filtering material becomes clogged or saturated, the brass tube is removed, cleaned, and repacked. This simple device has proved very effective, and in a few instances absolutely essential for the proper working of pilots.

Pilot outage due to draughts is a condition which lamp manufacturers have been attempting to minimize and eliminate. The seriousness of the trouble is primarily dependent upon the conditions under which the lamp burns, and whether it is an indoor or an outdoor lamp.

The luminous flame pilot is far from desirable in this respect, unless it is properly surrounded by a protecting casing, in which event it is very liable to carbonize. With upright lamps the pilots can be readily enclosed by the mantle (see fig. 1), and are thus efficiently protected. In the case of inverted lamps, the problem was more difficult. Investigation led to the adoption of the bunsen flame pilot-tip, and finally in a later modification to a type which is very difficult to extinguish (fig. 2).

With outdoor lamps the use of semi-bunsen pilots, surrounded by a protecting casing (fig. 4), has proved very satisfactory.

Radical changes in the construction of pilot tips, being experimented with at present, give promise of producing a practically inextinguishable pilot in the near future.

PILOT CONSUMPTION.

A consideration of the consumption of gas by pilots is of importance, in that consumers are often badly misinformed or entirely ignorant of its magnitude. The consumption is not only influenced by the length of flame which is judged adequate by the adjuster, but also upon the particular type of pilot bye-pass used.

The so-called "sub-flame" pilot bye-pass is, in reality, a simple device for turning low a gas-lamp. As the flame must burn over the entire surface of the burner gauze without danger of flashing-back, the consumption is naturally greater than that of an ordinary pilot.

The use of the "sub-flame" pilot bye-pass is rather limited, and the pilot consumption should not be taken as representative of the more efficient types.

The following table shows the normal consumptions of various types of indoor and outdoor lamps, and the ratios of the total gas consumption to that of the pilot consumption.

Lamp.	Normal Pilot Consumption per Hour (Cu. Ft.)	Approx. Length of Flame (Inches).	Pilot Consumption per Year (Cu. Ft.)	Normal Lamp Consumption per Hour (Cu. Ft.)	Lamp Consumption per Year Four Hours Daily. (Cu. Ft.)	Pilot Consumption per Cent. of Total Consumption.
One-burner inverted indoor, bunsen pilot	0·120	¼	1051·2	3·50	5,110	17·1
One-burner upright indoor, luminous pilot	0·095	¼	832·2	4·65	6,789	10·9
Three-burner inverted indoor arc, semi-bunsen pilot . .	0·147	⅜	1287·7	10·00	14,600	8·1
Five-burner inverted outdoor arc, semi-bunsen pilot . .	0·213	½	1865·9	17·50	25,550	6·8
One-burner inverted outdoor, luminous pilot	0·152	⅜	1331·5	3·45	5,037	20·9

These calculations are made on the assumption that the lamps operate on mixed gas at 2·5 inches pressure. Total heat value 650 B.Th.U. per cubic foot; sp. gr. ·660.

NOVEL USE OF BLUE-FLAME PILOTS.

As mentioned before, the essential reasons for changing from the luminous flame to the non-luminous bunsen flame pilot were because of the greater difficulty of extinguishing the flame of the latter by draughts, and the elimination of troublesome carbon formation or smoky flames.

In addition to these features, the non-luminous flame lends itself to a novel and efficient use. It has long been contended that the luminous flame pilot, instead of being considered a necessary expensive accessory of a gas-lamp, is in reality an efficient adjunct, in that it serves the purpose of guidance to the consumer desiring to turn on a lamp in a dark room. By placing the bunsen flame pilot so as to impinge on the mantle to the extent desired, an increase in the intensity of light of over five times that of the luminous flame pilot is obtained.

The following table shows the maximum horizontal candle power obtained from the two types of pilot flames:

Type of Flame.	Maximum Horizontal Candle Power.		Corrected Consumption Cu. Ft. per Hour.		Horizontal Candle Power per Cu. Ft.
Bunsen flame . . .	0·1612	..	0·126	..	1·28
Luminous flame . . .	0·0319	..	0·130	..	0·245

Open-flame candle power of gas burned in 8 feet tip, 22 at a 5-feet rate.

The increase in intensity not only serves as a better guidance in turning on the lamps at night, but to the dark adapted eyes it affords sufficient illumination to comfortably distinguish many objects in an ordinary living-room. This is obtained at a cost no greater than that of maintaining the luminous pilot-flame. In addition, it is more difficult to extinguish the flame of a pilot impinging on the mantle.

In cases where pilot illumination would be objectionable, it is merely necessary to turn the pilot-flame aside from the mantles, and practically no light is obtained.

A PROGRESSIVE BUSINESS.

Some seventy years ago, in the interesting old town of Brixham (situated on the promontory that shelters the very picturesque Tor Bay on the south-west side, and is famous for its fishing industry and for its iron ore mines and deposits), a Mr. Calley, who lived in a house in the New Road, started to build some fishermen's cottages on his adjacent property. But while in the course of making the foundations, he came across a deposit which, on examination, was found to be a natural ferric oxide of such peculiar properties that, when converted into paint and applied to wrought iron, it filled up the interstices and formed an integral part of the metal, and thus materially assisted in preventing corrosion and decay. He immediately stopped erecting cottages, and, in fact, turned those that were already built into a factory for the making of paints, which he designated "Calley's Torbay and Chemical Paints," and registered the trade mark of William of Orange stepping out of a boat on to the shore at Brixham (where he first set foot in England), using his expression "I will maintain" for his motto. To this day, the original factory can be seen among the various buildings in the New Road Works; while the original deposit has been extended, and mines are now worked for the excavation of oxide of iron, from which the present Torbay Paint Company derive their name as well as their registered trade mark "Torbay Paint."

This iron oxide, which is practically inexhaustible, is found in pockets that are of a volcanic nature, and may be exploited near the surface or as far down as 100 feet below; and it was probably formed by the percolation of the water running from the iron ore and being caught in these pockets. Upon being brought to the surface, it is taken to the washing works, where it is thoroughly pugged and run through a series of troughs, to take away all impurities and leave the pure oxide, which is then run through filter-presses under heavy pressure. The next process is to convey it to the drying-room, where all moisture is extracted; and it is then put through the grinding-mills, where 28-lb. cannon balls grind one against the other, and air is forced in underneath, which takes the minute particles up through a canvas trough into a chamber, where it is allowed to settle, when it is found almost silk-fine. The colour of the oxide is brownish, and is almost identical with the shade shown in the Company's new catalogue as their "No. 1 Brown." To obtain other shades, the oxide is calcined in retorts to a shade of red, and also to a black; so that when mixed with zinc oxide innumerable shades of colour can be obtained.

When the Company first started, they confined themselves to making four shades; but at the present time they have over a hundred standard shades, and it is possible for them to match any particular shade with reliability. They were the pioneers in the making of light shades from oxide of zinc in combination with oxide of iron—thus forming a paint which is non-poisonous and innocuous to the worker, whereas paint made from a lead base often produces colic or plumbism. The Company were also one of the pioneers in the enamel trade and varnish stain for wood floors. There is only one quality of "Torbay Paint;" and it is prepared specially for every class of work—attention being given to the manipulation of the oil medium to obtain the best results for under-coating and finishing. The Company emphasize the fact that the first or priming coat is the most important part of a painting operation, and has to fulfil a dual object, in that it must fill up the interstices in the surface of the material it has to protect and ensure perfect adhesion for the subsequent preservative coatings. The paint is extremely finely ground, by the aid of powerful machinery; and each colour is standardized according to weight, and has to pass through a very fine mesh before being sent to the customer.

It is interesting to note that the present partners in the firm (who have extended their ramifications all over the world, and made the name of "Torbay Paint" a standard to which engineers and others work their specifications) are Mr. Edward Stevens, who has been associated with no less than nine partners during his life, and whose two sons are at the head of the manufacturing departments, Mr. S. Freeman Burrows, and Mr. H. L. P. Allender.

At last week's meeting of the Society of Engineers, the premiums awarded by the Council for papers read during 1915 were presented as follows: The President's Gold Medal to Mr. Arthur H. Barker, B.A., B.Sc., for his paper on "Future Developments in Heating and Ventilation." The Bessemer premium (value £5 5s.) to Mr. Alphonse Steiger for his paper on "The Modern Development of Water Power." The Society's premium (value £3 3s.) to Mr. Sydney G. Turner, Assoc.M.Inst.C.E., for his paper entitled "Law and Engineering—Some Points of Contact." All three papers were noticed in the pages of the "JOURNAL" at the time they were read.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Calorific Standards in England and the United States.

SIR,—We have read with great interest the editorial comments in the "JOURNAL" for Sept. 28 last, on the paper presented by our Mr. M'Bride at the International Gas Congress. This editorial and a number of other items which from time to time have been printed in the British gas journals raise a question in our minds which is, we believe, of considerable importance.

The problem of a selection of the proper heating-value standard for gas is, as we view the question, primarily an economic problem. It is highly desirable that the customer should secure the largest measure of useful energy for each dollar of cost to him. Starting from this assumption, which we believe is unassailable, it becomes a question of determining the amount of useful heat which can be made available to the user of gas for each dollar of cost, since in general we must employ the unit of useful heat as the measure of service rendered.

The question which we would like to ask of British engineers is this: Does the very low heating value per cubic foot which is permitted under standards for gas quality in Great Britain operate to the advantage of the customer, or would the customer and the company be better cared-for if the quality might be increased (say) by 5 or 10 per cent. with a corresponding increase in the price charged for gas? We would like to address to a number of the best informed engineers of your country the following question: Would you prefer to deliver gas of (say) 5 or 10 per cent. greater heating value per cubic foot if you could secure for such gas an increase in price of 5 to 10 per cent.? We will be glad to have you refer this inquiry to a number of prominent engineers personally or give us the names of such engineers as you believe could best answer the questions presented.

We would have it understood that the Bureau of Standards is perfectly willing to advocate a much lower heating value standard than that which now prevails in the United States, if thereby better service to the users of gas can be ensured. However, with the data which have been presented to the Bureau up to the present time, we are unable to conclude that a marked reduction in gas quality would thus serve the public interests. When we have assumed an adequate percentage of return on the necessary investment of the companies, and a reasonable allowance for maintenance, depreciation, and all operating expenses (including taxes for each of several qualities of gas), we have failed to find in any case yet studied any material advantage in favour of gas qualities below 575 to 600 B.Th.U. per cubic foot. On the other hand, in a number of cases investigated, the data seemed clearly to indicate that the advantage to the customer lies rather with the higher quality of gas. In contradiction to this generalization, we have frequently presented to us the arguments that British conditions demonstrate that our position and conclusion are not correct.

We have read with interest numerous articles which have been presented on this subject by British engineers, but have not been satisfied as to the correctness of this statement which is made to us. It is because of this difference of opinion, which appears to exist not only in the United States but in your country, that we address you at this time in the hope that further valuable suggestions may come to us, and perhaps that an exchange of opinions between the United States and your country may be profitable to both.

S. W. STRATTON, Director,
Department of Commerce—Bureau of Standards.
Washington, Jan. 7, 1916.

[This letter, the publication of which has been unavoidably delayed, is dealt with in our editorial columns to-day.—ED. J.G.L.]

Lighting of Railway Trains.

SIR,—With reference to the article you reproduced from the "Engineer" in the "JOURNAL" for the 1st inst., I should not like the statements to go unanswered, because they seem to favour the electric light more than is necessary. So, in the interests of the gas industry, would you insert this letter in the "JOURNAL," not so much for the information it contains as in the hope that others may be able to make useful suggestions to enable the railway companies to continue the use of gas, which is undoubtedly the cheaper form of light. In addition to certain difficulties in lighting, it will be a long time before electricity will be able to efficiently replace gas in the kitchens of the railway dining-cars; and these cars are being more extensively used every year—even on the short tracks of the British railway companies.

The great danger appears to me, not so much from the gas-lamps themselves, but owing to the very high pressure of the storage tanks; and these, being under every carriage, add considerably to the danger. I think in future it might be arranged that the gas-tanks, if not on a small separate carriage should be either on the engine tender or in the guard's van, and the pipe-connections for the lamps on the carriages connected up by flexible tubes which for high-pressure gas might be about one-quarter of the size used for the vacuum brakes, and therefore more readily joined-up than these connections. This being so, any serious accident would probably sever them, or arrangements could be made, if thought desirable, that they would undoubtedly be disconnected, and by some special contrivance the gas could be retained for reconnection as soon as it was considered advisable to do so.

Having a universal pipe connection for all the carriages, the supply could readily be arranged to be under the control of either the engine-driver or the guard. This would be another safeguard in the case of accident, and again would very much add to the economy of the gas for trains that are at present lit simply for the sake of a few tunnels. In such cases the lights are now frequently turned on long before it is necessary, being more convenient to light up before the train starts from the station than when it is actually dark.

Other advantages of the gaslight being under the control of the officials running the train would be apparent. In the event of aërial raids on the districts the trains are running in, instructions could be given from the first signal-box to reduce the lights in the case of emergency, without the necessity of stopping the train.

If there is anything original in my ideas, I hope this letter will bring further information for the benefit of humanity.

E. B. Waller.

Brimscombe, Feb. 7, 1916.

A Plea for Showroom Reform.

Sir,—I ask your kind indulgence in offering a few observations on the article by Mr. Cyril G. Davis in your last issue.

I may say at once that there is, in my opinion, very little contained therein to which exception could be taken. At any rate, he placed (taking human nature as we find it) a showroom attendant in a position of immense superiority, both intellectually and morally; so that "short of the inevitable pair of wings" he should indeed be a very desirable person to meet. It is, however, very difficult to get all these nice ideas developed, if other things are not equal.

I have read from time to time many admirable articles on salesmanship—all very impressive. In fact, during the process of reading, a kind of glow seems to rise in one's cheeks as to how important a man one is to the undertaking to which he belongs. This feeling of pride is, however, somewhat discounted when, upon reflection, one realizes that the quarter's rent and the rates are due. The wife, too, has mentioned the day before that some of the children require new boots. Perhaps, also, quite incidentally a glance is given at one's own trousers, and it is found that, although the crease is well developed, they are exceedingly "baggy" at the knees.

I say emphatically, one cannot get efficiency unless the salesman is paid a salary which will remove him from financial worries. I mean by that, a remuneration such as will enable him to put by a little for the time when he is too old to work, as well as to live decently. It is not sufficient for a man to dress expensively at the showroom, and allow his wife and family to feel the pinch at home.

There is also another aspect of this question to which Mr. Davis does not allude. It is that the showroom attendant should be allowed to feel that he is the firm, just as well as any other officer. The fact of his being so much in touch with the public is worthy of this alone.

I am quite sure, if all gas companies and firms connected with the gas industry would realize this important duty to their salesmen, they would get a much greater profitable return.

Feb. 11, 1916. A Showroom Attendant.

Gas Matters at Ripon.

Sir,—My attention has been drawn to the paragraph under the above heading which appeared in your issue of Feb. 8.

The report is most misleading; and, in order to contradict any possible misinterpretation of the paragraph, I wish it to be made known that at the meeting of the Ripon City Council on Jan. 31, no reflection whatever was cast on the Consulting Engineer, Mr. J. W. Dunn, whose experience in regard to vertical retorts and gas-works practice is undoubted. It was thought wise to call in additional expert advice in order to strengthen and confirm the opinions expressed by Mr. Dunn.

J. Brown,
Chairman of the Gas Committee.

Town Hall, Ripon, Feb. 12, 1916.

Coal Haulage at the Southport Gas-Works.

A month ago, the Southport Corporation Gas Committee considered the question of the provision of some means of haulage of coal-waggons from the gas-works at Blowick to Crowlands, consequent on the demands of the Government for horses, and the extra expense of maintenance of the latter. The Committee then decided to recommend that a locomotive should be purchased; but later Mr. Richardson (the Chairman of the Gas Committee) asked permission to take the recommendation back, as they had an alternative proposal to consider—the use of electricity. A number of experiments have been carried out, as a result of which Mr. Richardson, at the last meeting of the Council, in moving the new minutes of the Gas Committee, said they now recommended that the Electricity Committee should carry out a scheme, and charge the Gas Committee 1½d. per ton. This came pretty near the price it would cost to do the work by steam locomotive. The Gas Committee did not hold themselves responsible for the work being carried out, or the amount it was going to cost. In the course of a discussion as to why the Electricity Committee had reduced their original estimate of 1¾d. to 1½d. per ton, Mr. Hampson (the Chairman of the Committee) said he had gone again very carefully into the matter, and found the cost was 1¼d., or, to be exact, 1·2d. per ton. The minutes were approved.

Concession to Large Consumers at Leigh (Lancs.).—The minutes of the Leigh (Lancs.) Town Council, which were confirmed at the last meeting, showed that, as from Jan. 1 last, the charge to consumers of 1 million cubic feet of gas for trade purposes will be 2s. 9d. per 1000 cubic feet, less a discount of 3d. for prompt payment.

Coal and Oil Matters Discussed at Oldham.—At the last meeting of the Oldham Gas Committee, Alderman Wilde, J.P., the Chairman, again alluded to the serious position they were in regarding coal supplies for the gas-works. In a report submitted by the General Manager (Mr. Arthur Andrew), it was reported that stocks were now so low that there was a danger that they might not last out. The Committee had repeatedly pressed the contractors for delivery, but without tangible result. The total shortage on the seventeen contracts for this year was 15,000 tons. Mr. Tim. Duxbury, the Gas Engineer, informed the Committee that local contractors were doing a little better in regard to deliveries, but they were still a long way behind contract times. Other collieries had written saying they were doing their best regarding deliveries, and had urged the Committee to put the serious position of affairs before the Government. Owing to the scarcity of coal, and the necessity of preserving as much stock as possible, it was essential that the Committee should purchase 30,000 gallons of gas oil, although the price was 100 per cent. more than before the war. The recommendations were agreed to.

REGISTER OF PATENTS.

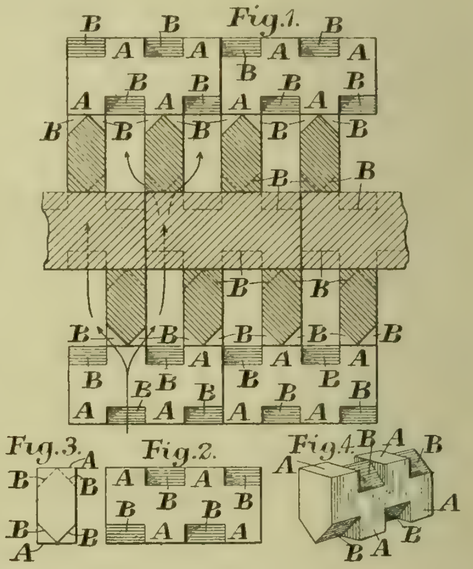
Chequer-Bricks for the Chambers of Carburetted Water-Gas Plants.

Davison, E. J., of Cricklewood, N.W., and Tooley, C. P., of Leeds.

No. 745; Jan. 18, 1915.

This invention relates to improvements in chequer-bricks of the type described in patent No. 436 of 1906, with the object of further preventing or minimizing the lodgment of dust or carbon in the chequers, of further reducing the friction of the gases passing through the chambers, and of providing for the breaking of the joints between successive courses of the chequer-bricks.

The chequer-brick is constructed with alternate square pedestals and double-bevelled recesses both on its upper and lower surfaces; but the pedestals and the recesses are each equal in length to the unit width of brick, and are thus equal and uniform, while the double-bevelled recesses are in all cases formed with a fine edge in lieu of the rounded or extended edges hitherto proposed. The pedestals and recesses are arranged in staggered formation—each pedestal at the top being opposite a recess at the bottom, and each recess at the top opposite a pedestal at the bottom. Thus when the chambers are built up, with the bottom pedestals of each brick bearing on the upper pedestals of the course of bricks at right angles below it, "a double-bevelled fire-edged recess occurs at the top and bottom of each brick at all points where the gases are in contact, and the lodgment of dust or carbon in the chequers is thereby prevented, and the passage of the gases at the same time facilitated."



Davison and Tooley's Chequer Bricks for Water-Gas Producers.

Fig. 1 is a sectional elevation of part of a chequering chamber built up as mentioned, A being the square pedestals and B the double-bevelled fire-edged recesses of each chequer-brick. Fig. 2 is a front elevation, fig. 3 an end elevation, and fig. 4 a perspective view, of a single chequer-brick of the form shown in fig. 1.

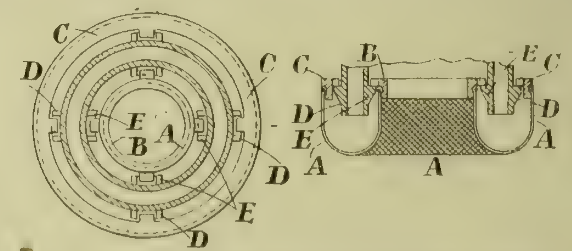
The pedestals A and recesses B may be so arranged in each chequer-brick as to provide for each successive course of bricks being set either flush with the joints of the preceding course in the usual manner, or to break joint with same. In the latter case the pedestals at the extreme ends of each chequer brick would be of a length equal to one-half only of the unit width of the brick. Also, the bevel of the recesses might be either flat or curved and at any angle or radius; but the recesses in all cases must be formed with fine edges.

Incandescent Illuminating Mantles.

Cars, B., of Highbury, and Palmer, W. D., of Muswell Hill, N.

No. 1004; Jan. 21, 1915.

This invention has for its object to provide means for removably attaching an annular double-walled mantle to a burner nozzle.



Cars and Palmer's Double-Walled Incandescent Mantles.

A plan and section are given of an annular double-walled incandescent mantle, having the invention applied to it.

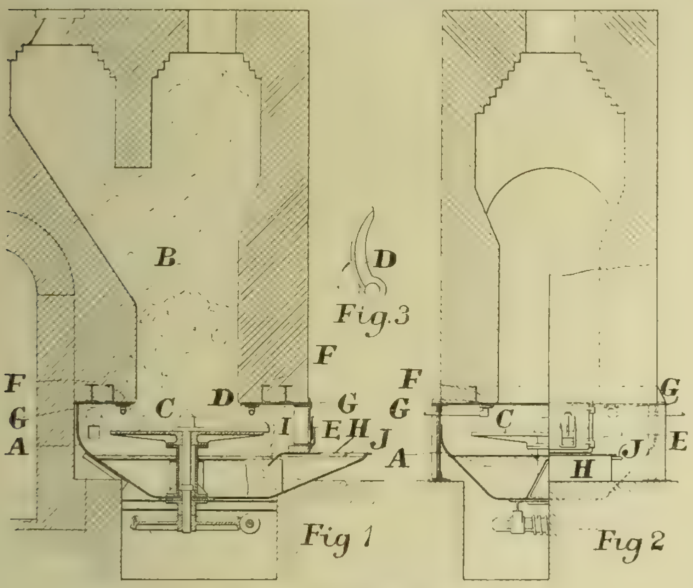
The mantle (designed for use with a high-pressure burner) is formed with double walls A having a space between them, in which the flame burns. The mantle takes the form of an annulus, the double walls having a U or gutter-like section at any part of the circle, and is usually employed with a correspondingly shaped burner. The means for attaching the mantle to the burner nozzle consists of two rings B C, of refractory material, one carried by each wall. The inner ring B is furnished with external lugs or projections, while the outer ring has internal lugs. The burner nozzle is furnished with corresponding lugs or catches D E.

Gas-Producers.

Glover, S., of St. Helens, and West, J., of Southport.

No. 5315; April 8, 1915.

This invention has for its object to provide a simple arrangement of parts around, and in combination with, the ash-extracting means at the lower end of the producer furnace, so as to "ensure high furnace efficiency with uniformity of gas production by obviating the employment of clinkering or ash-extracting doors or valves."



Glover and West's Gas-Producers.

Fig. 1 is a sectional elevation of the producer. Fig. 2 is a view at right angles—the left-hand part being in section and the right-hand part mainly an elevation. Fig. 3 is a plan of the mechanical extractor.

There is a chamber or casing A around the lower end of the producer B. It surrounds the furnace grate C and ash-extractor D, and receives the ashes discharged. The primary air for the furnace is obtained through slide-controlled apertures E, in the chamber wall—"preferably disposed equidistant around the chamber, so as to ensure a more uniform distribution through the fuel in the furnace."

Around the underside of the lower part of the furnace and on the upper wall F of the chamber is provided a channel G, with apertures or slots in it through which water can be projected, in spray form, on to the ash on the grate, so that the steam generated, rising through the fuel, maintains a sufficiently reduced combustion temperature to prevent fluxing of the ash. The unevaporated water flows over the ash and keeps the metal in contact with it at a low temperature.

The mechanical extractor D comprises a vane-like element adapted to be slowly rotated over the surface of the grate C at a distance from the lower open end of the furnace B; the dimensions of the grate being such as to ensure that the ash can rest on it at its angle of repose, and so prevent the self-discharge of the furnace. The ash falls from the grate into a water-sealed container which forms the lower part of the chamber A; and access to the bath, for withdrawing the ash, is obtained by way of the mouth H projecting beyond the furnace—a lip-like part I dipping into the water adjacent to the mouth so as to prevent ingress of air to the furnace, notwithstanding small variations in the level of the liquid in the bath. The level of the water in the bath is maintained constant by an overflow pipe J.

Liquid Meters.

Alger, H. C., of Chicago, U.S.A.

No. 2494; Feb. 16, 1915.

This invention relates to meters of the type in which the liquid being measured flows through a weir opening formed in a weir-plate so curved that the rate of flow through the weir opening is in direct proportion to the head. The object aimed at is to provide a meter in which the area of the plate containing the weir opening is reduced to a minimum, with a consequent reduction of resistance to the flow of the liquid, and in this and other ways to improve the construction of such meters whereby they will be "efficient and accurate in operation" and the necessity for abstruse or complicated calculations will be obviated.

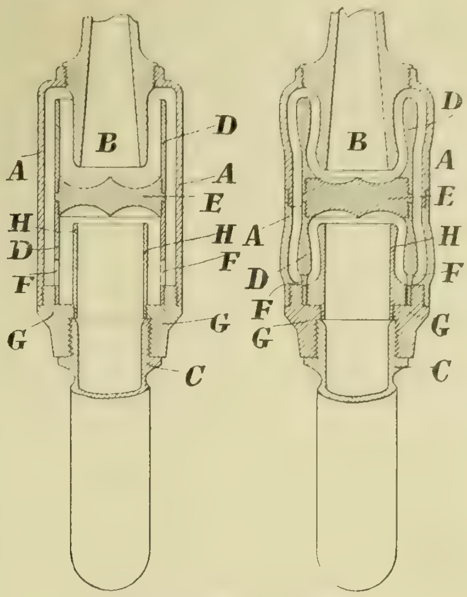
For this purpose, the opening is provided about its edges with laterally extended narrow strips, which cause the liquid to fall clear of the walls of the weir frame so as to avoid the trickling of the liquid down the wall faces as has heretofore sometimes been the case. Furthermore, the opening for the passage of the liquid is preferably enclosed by upwardly extending walls of gradually increasing height—the narrow curved strips being formed at the upper ends of the walls and extending part of the way across between them and forming a curved surface, between the parallel lateral edges of which is left a weir to measure the flow of liquid.

Incandescent Gas-Burners.

Tilley, F. C., of Kingsland Road, N.E.

No. 5941; April 20, 1915.

This invention, relating to the construction of inverted and other incandescent gas-burners, has for its object to construct the burner so that the mixture of air and gas "is properly combined before reaching the point of ignition."



Tilley's Incandescent Burner.

Sectional elevations of two forms of the device are shown.

A cylindrical chamber A is formed, into one end of which enters the usual mixing-tube B, and to the other is connected the burner tip or nozzle C. Inside the chamber A is positioned concentrically a tube D, which is smaller in diameter than the chamber A, and in which is a dividing wall E across about its middle. The tube D is preferably secured to the one end or bottom of the chamber A, and reaches nearly to the top. It is provided with holes F near its base. The wall E is preferably made thicker in the middle and edges than between the middle and edges, so that an annular recess is formed on each side of the wall as shown. The usual mixing-tube B passes down some distance into the chamber A, and is surrounded by the top part of the tube D, so that the end of the mixing-tube is only a little distance from the dividing wall.

On the base G of the chamber A is positioned another tube H, of about the same diameter as the opening of the burner tip or nozzle C, and, projecting up into the tube D, reaches nearly to the wall E.

The passages through the appliance are relatively of the same area throughout (so that the mixture in its passage passes freely through); the size of the passages being determined by the required quantity of gas to be used, allowance being made for expansion by heat.

In use the mixture of air and gas, passing out of the tube B, strikes against the side of the wall E, and passes inside the tube D over the end and along the outside and between it and the wall of the chamber A, and through the holes F at the bottom (or it may be under the bottom), and then between the inside of the tube D and the outside of the tube H; being diverted by the other side of the wall E and passing along the inside of the tube H and out of the burner tip C. Owing to the many changes of direction of flow, the patentee remarks, the fluid has become thoroughly mixed.

Gas-Producers.

Morgan, P. B., of Worcester, Mass., U.S.A.

No. 6999; May 10, 1915.

This invention relates to the class of gas-producers for the production of fuel gas—particularly for effecting the automatic discharge of ashes therefrom. The essential features of the invention are not described apart from a number of sheets of detailed lettered drawings.

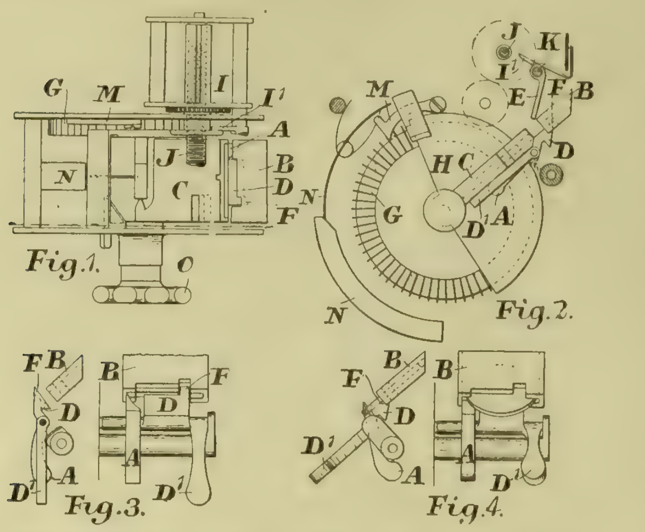
Coin-Freed Prepayment Mechanism.

Mercer, A., of Longsight, Young, E., of Droylsden, and Meters Limited, of Manchester.

No. 6739; May 5, 1915.

This invention relates to means for controlling the passage of coins through the coin-shoot in gas-meters by providing (adjacent to the shoot) two independent pivoted arms or levers adapted, when in their normal position, to obstruct the egress of coins from the shoot, but to be moved clear of the latter by the movable coin-holder of the prepayment mechanism when the holder is brought into place to receive a coin from the shoot. One of the levers prevents the egress of a second coin from the shoot when two coins have been placed in it immediately after one another; and the other lever prevents egress of coins from the shoot when the prepayment mechanism has been operated to the full prepayment capacity.

Fig. 1 is a plan (partly in section) of the coin-freed prepayment mechanism referred to. Fig. 2 is a sectional elevation. Fig. 3 shows two views at right angles to one another of the means for preventing the passage of coins through the coin-shoot. Fig. 4 shows similar views, but with a coin in position ready for the reception by the movable coin-holder.



Mercer and Young's (Meters Limited) Coin-Freed Prepayment Mechanism.

The lever A is mounted adjacent to the base of the coin-shoot B; the lower end of the lever being weighted to cause the other end to rest normally in a position in which it prevents the egress of coins from the shoot. The lever preferably has its acting end rounded or shaped at the part where it lies adjacent to a coin issuing from the coin-shoot, so that should two coins be inserted immediately after one another in the shoot and one be received by the movable coin-holder C of the prepayment mechanism, then, upon the holder being rotated clear of the base of the shoot, the shaped end will move in front of the coin in the shoot and prevent its egress therefrom (see fig. 4). The coin-holder C, when positioned to receive a coin from the shoot, engages the lever A above its pivot point, and holds it in a position clear of the shoot, so that a coin in the shoot can travel into the coin-holder.

A second weighted lever D is provided for obstructing the egress of coins from the shoot when the prepayment mechanism has been operated to its full prepayment capacity. The end D^1 of the lever D serves as a weight to hold it normally in position to obstruct the passage of a coin from the shoot to the cash receptacle. The coin-holder, however, engages the lever above its pivot point, and moves it clear of the shoot when the holder is in position to receive a coin from the shoot. When a sufficient number of coins have been placed in the coin receptacle at one time, the arm E of the prepayment mechanism is traversed by the member I (actuated by gearing from the wheel G) through the arms I^1, so that it engages the projecting piece F on the lever D and prevents the movement of the lever to allow of the passage of coins into the coin-holder. The consumption of gas causes the withdrawal of the arm E from contact with the lever D by the rotation of the screw J by the gas measuring mechanism.

No claim is made in the present application to any particular form of prepayment mechanism. That shown comprises a wheel G having teeth upon its face for engagement by the coin in the coin-holder C. An adjustable guard H controls the period in the rotary movement of the holder C at which the coin in the holder enters the teeth of the wheel G. The rotation of the latter through the medium of the coin in the coin-holder causes the rotation of the member I on the screw J. The arm E is put in operative connection with the member I by arms I^1, so that it is traversed with it upon its supporting rod K, but is not rotated by it. The gas-measuring mechanism of the meter rotates the screw J. A pawl M prevents backward rotation of the wheel G, and a guard N prevents the coin from falling out of the coin-holder until the operative traverse of the latter is completed.

LEGAL INTELLIGENCE.

WORKMAN'S COMPENSATION CLAIM.

Action Against the Wandsworth Gas Company.

At the Wandsworth County Court on the 7th inst., before Judge Harington, the Wandsworth, Wimbledon, and Epsom District Gas Company were defendants in an application for an award under the Workmen's Compensation Act, brought by Henry Ferrier, a service-layer's labourer.

Mr. Sidney Lamb was Counsel for the applicant, and Mr. Ellis Hill (instructed by Messrs. Sloper, Potter, and Goschen) appeared for the defendant Company.

Applicant, giving evidence, stated that he had been in the employment of the defendants for a number of years. On Jan. 11, 1915, he was getting out some pipes from the pipe-rack in the yard of the Mitcham Gas-Works, when one of them fell on his thumb, bursting it open. He reported the accident to the Assistant Superintendent, but continued his work for two days. He afterwards went to Dr. Love, who gave him a certificate, which applicant took to the works; and he was told that he must stop work at once. He was attended by Dr. Love, who, on Jan. 23, advised him to go to the hospital. He had attended St. Thomas's Hospital, where his thumb was operated upon. Applicant could not use his hand because he could not grasp anything with the thumb.

In cross-examination, witness said he had suffered from blood poisoning in his thumb. His thumb had not healed up by June. Dr. Love had told him that he had better do some light work; but the Superintendent said there was not a light job to suit him.

Counsel referred to the fact that the Company, in December, wrote offering applicant light work in assembling parts of gas-cookers, &c.

Applicant said he was not able to do this work.

In further examination, applicant said he had undergone massage treatment.

Dr. *Richard Theodore Timberg*, Medical Officer in charge of physical exercises and massage at St. Thomas's Hospital, said he first saw applicant in May, 1915, when he prescribed treatment; but applicant did not improve under it, and was discharged. In December he came back, and was then put under massage treatment. In his opinion, the loss of flesh on the inner side of the thumb had brought the nerve end up to the surface; and this was what produced the pain.

Sir *John Colley*, called by the Gas Company, said he saw applicant with Dr. Love, in December. He found on examination that the terminal joint of the thumb was stiff from want of use, and partly from the remains of a former inflammation. The condition was almost wholly the result of want of use. He had examined him carefully for tenderness over the scar and generally over the whole thumb, and he made no complaint. There was no evidence of the nerve being involved in the scar tissue, for the only possible evidence of such a condition would be extreme tenderness and complete incapacity to submit to the examination which he made. Applicant would not have been able to stand massage, which, obviously, was the worst possible treatment for a scar which involved a nerve. The proper treatment would be to cut down to the nerve and remove it. If the applicant were really anxious to do work, he could do anything; but he (witness) thought for some time he ought to be excused wielding a heavy hammer, which, applicant had stated, was part of his work. He would certainly be able to do such work as assembling parts of stoves.

Counsel: The man says he is suffering pain. What is your view of the right treatment for this thumb?

Witness: Work—and work only, and being compelled to do it.

Dr. *Henry Love* having given evidence,

Mr. *Arthur F. Ball*, the Chief Inspector at the Mitcham Works, stated that he remembered applicant coming to the works in April with a certificate from Dr. Love. The matter was talked over, and it was suggested that applicant should come and see him in a week's time; but he had not seen him since. In December, the work of assembling stoves was offered to applicant at his old wages. Witness described what the work consisted of.

In cross-examination, witness said he did not tell applicant, when the latter came to see him, that he would communicate with Dr. Love and let him know. He had no recollection of seeing applicant since April 27. From that date until Dec. 10 last the Company had been paying him half wages.

The Medical Assessor having examined applicant,

His Honour said the question was purely a medical one. On the evidence of Dr. Love (applicant's own doctor), and that of Sir John Colley, it was shown that the man was perfectly fit for light work so far back as June last, and even earlier—in April. Work which he could have done was offered to him in December. He declined to attempt to do it; and now he had come to the Court—his compensation being stopped—to ask for an award. The Medical Assessor was entirely of opinion that, if applicant had taken the advice which was offered to him, and done the work he was capable of doing in December, he would now be in a condition to do his full work. He made an award in favour of the respondents, with costs.

Wilts County Gas Company.—Action on Guarantee.

The action of *Wilts County Gas Company v. D'Arth and Another*, which was brought to recover the amount due under a guarantee, was in the list for hearing last Wednesday before Mr Justice Ridley in the King's Bench Division of the High Court of Justice. Mr. Lincoln Reed, who appeared for plaintiffs, said he was glad to say the Court would not be troubled with the case, as the parties had come to terms. By consent, there would be judgment for plaintiffs for the amount claimed on the writ, and certain terms had been arranged as to execution which would be handed in to the Associate. Mr. S. Lynch, for the defendants, said he agreed to the order in the terms arranged. His Lordship entered judgment accordingly.

Claim against the Dublin Gas Company.—Mr. Justice Pim, in the High Court of Ireland, has affirmed a decision of the Recorder of Dublin dismissing a claim by Mr. R. E. Burnes, clerk, against the Alliance and Dublin Consumers' Gas Company for £12 10s. for work done, and £1 6s. the amount of fines which he alleges were improperly deducted from his salary.

Birmingham to Pool Coal Contracts.—Hitherto the Birmingham Gas and Electricity Committees have purchased their coal separately; but a Sub-Committee have now been appointed from the members of both Committees who will be empowered to enter into contracts for all the coal needed by the two undertakings. It is hoped that a great saving will accrue from the reduction in the number of contracts and the larger quantities which will be ordered under the contracts entered into. The scheme will be put into operation shortly. If the successful results which are anticipated are realized, it is expected that the system of "pooling" contracts will be extended to other requirements. The Lord Mayor is Chairman of the Sub-Committee appointed to carry out the negotiations; and in the instructions it is laid down that they may purchase coal, on request, for any other Committees of the Council.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of Proprietors was held on Wednesday last at De Keyser's Royal Hotel, Victoria Embankment, E.C.—Mr. CHARLES CARPENTER, D.Sc., in the chair.

The SECRETARY (Mr. F. M'Leod) read the advertisement convening the meeting, and the minutes of the last ordinary general meeting. The seal of the Company was affixed to the Register of Proprietors.

THE CHAIRMAN'S SPEECH.

The CHAIRMAN: Ladies and Gentlemen,—I have now to move: "That the report and accounts now presented be received and adopted, and the report entered on the minutes." In the first paragraph of the report you have the key to the working of the Company during the past half year; and I do not think a perusal of it will lead to any other conclusion than that the Board decided rightly when they determined to raise the price of gas to 2s. 10d. per 1000 cubic feet—the amount carried forward being barely the equivalent of ½d. per 1000 cubic feet. By raising the price to 2s. 10d. per 1000, we have made both ends meet, with an amount to spare equal to ½d. per 1000 cubic feet. The exact figure would have been 2s. 9½d.; but we had to raise it to a round figure, and so there is a small balance to the good.

THE SLIDING-SCALE AND THE DIVIDEND.

The dividend is automatically reduced in consequence to £4 8s. per cent.—a considerable drop compared with that customary before the outbreak of war. As a matter of fact, the constitution of the Company, if I may so describe the Acts of Parliament under which we work, was never framed to meet war times; and there is no doubt, in my mind, that the dividend payable does not represent an adequate return for the risks and difficulties inseparable from carrying on a business of this particular complexity and magnitude, and which increase rather than diminish—in other words, that the sliding-scale is not giving even justice at the present juncture. There is, however, no use in quarrelling with it, as certainly no remedy is possible during the continuance of the present struggle, and we must be content to make the best of it. I need not remind you that the general principle of the Sliding-Scale Acts, under which we work (and to these must be added the co-partnership), is that the burden of bad times should not fall wholly upon the consumers of gas, but should be borne, in addition thereto, by the shareholders and workmen. When, therefore, you consider how much the dividend has fallen, I would ask you to remember that the consumers are also suffering by reason of the increased price charged for gas, and the employees by reason of the diminished bonus earned under the co-partnership scheme. The burden has, at any rate, been shared. Could it have been mitigated?

COAL DIFFICULTIES.—THE FREIGHT QUESTION.

In discussing this, it will be necessary to first turn our attention to coal charges. We were for many years accustomed to buy coal delivered into our works at practically the same price as that which we have been asked to pay for its freightage alone to London during the past half year; or, to put the matter in another way, we used to buy our coal delivered alongside our wharves at a price somewhere about that which we paid for coal last year put into steamers in the North. I think these two facts will allow you to form a very good picture of the difficulties we have had to encounter in providing our supplies of raw material. I do not think, however, I can usefully add to the remarks upon the subject I made in this room six months ago, except to say that the position generally does not show signs of improvement. Some one must be making huge profits; but it is certainly not the gas companies. As you are aware, Parliament has now placed a limitation on the price to be charged for coal. That it is liberal may be judged from the fact that it is practically double that ruling ten years ago. An even more serious matter has been that of shortage arising mainly from the large number of miners who have enlisted. But as long as the Coal Export Committee keep their hands upon the export, the industries of this country should not run short. The handling of the freight question has been very disturbing; for the Government continues to ask for the use of interned vessels between three and four times what was paid in pre-war times One is tempted to ask why it did not endeavour to control carrying freight by sea as well as by land, since our shipping is no less necessary to our existence than our railways. There is a Joint Board of Control for the latter; and I cannot see why the same principle could not be applied to our mercantile marine.

IMPROVEMENTS IN RESIDUALS.

Now the report goes on to tell you that some improvement has taken place in residual products. This is true of the three mainstays of our business—coke, tar, and ammonia—but, unfortunately, we cannot take full advantage of the higher values. In ordinary times we have a good market for our coke in the Northern parts of the Continent. Being made from Durham coking coals it has a ready sale at a good price. But having regard to the importance of keeping the Metropolis fully supplied with fuel, its export therefrom has been almost wholly restricted, in order that it should be available for home use. We cannot complain of this Looked at broadly, it is, I think, a proper course for the authorities to adopt; but we are prevented thereby from disposing of our coke to the best advantage, having regard to the high price the raw material from which it is produced costs us. Of our tar products, the most important is pitch. There again, we produce a high-class make for which we have gradually built-up a good demand from the Continent. We could sell all our make there at good prices, for it is badly wanted by our Allies; but, unfortunately, the enormous rise in freights has checked our business very considerably, and has necessitated the stocking of quantities which, with reasonable freights, would find a ready sale. Our third great residual is ammonia, the demand for which is very heavy, and the export value of which is very high. The Government have, however, intervened; and, by the power they possess of restricting its shipment, they have fixed a moderate figure at which sales for home agricultural purposes must be made. Again, I do not complain of this. I think they are performing their duty to the country by their action; but I would point out to you that it all goes to prevent our making both ends meet without considerably increasing the price of gas to our customers. In other words, while we have paid heavily for coal, we have only been able to partially reimburse ourselves from residuals.

DECREASED GAS CONSUMPTION.

As regards the consumption of gas, I do not think, despite the decrease we record, this can be considered unsatisfactory. It must be remembered that, in addition to the ordinary public lighting, the high-pressure installations, which have figured prominently in recent reports, have been completely shut-down. In addition to this, there has been a substantial reduction in the consumption for shop-lighting, which is not to be wondered at when the change of shopping habits is taken into consideration. The domestic consumption appears to be unaltered, although from the gas-fire point of view the season has been a very unfavourable one. There has been a substantial increase in the use of gas for industrial purposes; and it is interesting to find that, although to produce a given amount of heat a pennyworth of coal has greater potentiality than a pennyworth of gas, yet the experience of large-scale installations goes to confirm what has already been demonstrated in the case of the cooking-stove—namely, that, owing to the ease of controlling the temperature and the fact that the losses of lighting-up and cooling-down are reduced to a minimum, gas can be profitably substituted for solid fuel in many cases where, on paper, want of economy would be predicted. Perhaps here I might say a word with regard to our production of gas. We have maintained throughout the half year the high quality and purity to which our consumers have become accustomed, though I regret our production per ton has not equalled in quantity that reached in pre-war times. The authorities are now asking gas undertakings to extract liquid hydrocarbons from their gas. Where water-gas plant exists, this is comparatively an easy matter, as the deficiency can be rectified by enrichment. We have, however, no water-gas plant, and must therefore consider some alternative method—a task which is not an easy one, but which we shall doubtless solve. I propose to deal with the next paragraph of the report when we get to the Wharncliffe meeting, at the conclusion of the present one.

LABOUR SCARCITY.—WAR BONUS.

I must now say a word with regard to the shortage of labour. But before I do so I ought to call your attention to a large item which appears for the second time in our accounts. It is described as "War Bonus and War Fund, £31,505." The bulk of this amount falls under the first item of war bonus. We have followed in this respect the example that the Government adopted in the case of the railways. Having regard to the increase in our charges for gas, we did not feel justified in granting increases of wages to meet the enhanced cost of living; but we felt that we were justified in paying a bonus in respect of the increased cost of living, which is at the same rate as that given to the railwaymen, whose circumstances of employment have some features in common. Dealing, now, with the supply of labour, there has not been a shortage in the ordinary sense of the word, for we have at all times been able to fully man our various works. But we have suffered by reason of shortage of skilled and unskilled labour trained to, and familiar with, the special conditions of our particular requirements.

CO-PARTNERS WITH THE COLOURS.

This will be readily appreciated when I remind you that we have lost the services of over 2200 of our employees, among whom were many exceedingly capable men. We have replaced them by others who are mostly above military age or unfit from the military standpoint. They have undoubtedly done their best, as have those who continue in our service, carrying (and willingly) a greater burden than is required or demanded in ordinary times. We have, in other words, sacrificed something of efficiency to the exigencies of the military situation. We have interposed no obstacle in the way of the man who desired to serve his country; and I am pleased and proud to tell you that we have sent two men to the Colours for every one furnished under corresponding circumstances elsewhere. That is, I think, a very remarkable fact; and I do not think it would have come about had it not been for the teaching of the duties of citizenship which, under the co-partnership system, our men have been brought up and trained in.

THE NEW CHIEF ENGINEER.

There is one other matter which, in conclusion, I must mention, and that is with regard to the Chief Engineer. The Board have filled the important post of Chief Engineer by the appointment of Mr. G. M. Gill. I have some knowledge of the arduous demands made upon the occupant of such a position. It is not enough that he should have a sound knowledge of his profession, but that he should have the health and energy necessary to enable him to practice it. Mr. Gill came to us with the highest credentials; and from what I have seen of him in his new position, I have every confidence that he will justify our choice. That concludes what I have to say with regard to the report. I will defer my remarks about the Bill until the Wharncliffe meeting. I beg now formally to move the resolution.

The DEPUTY-CHAIRMAN (Mr. Kenneth P. Hawksley): As the Chairman has so fully covered all the items in the report and balance-sheet, I do not think there is anything I can usefully add to what he has said. I have much pleasure in seconding the resolution.

The CHAIRMAN: If any lady or gentleman desires to make any remark on the report, we shall be very pleased to listen.

REMARKS BY SHAREHOLDERS—AN APPRECIATION.

A SHAREHOLDER asked for some further information of an item in the capital account showing the actual amount of money raised and expended—"Received since June 30, £180,000, less £32,400." He understood the Company were raising £100,000 on that particular occasion at £82 per £100 for the purpose of purchasing boats; and he should be glad to know if any had been purchased. "Temporary loans" in the last balance-sheet stood at £360,000, and now it was

£470,000. How was it the amount had increased when they had the £180,000? He also desired to know whether the amount paid for freight had decreased.

The Chairman: We have on order at the present time some new vessels, and towards their construction we have paid a substantial amount. You cannot buy a ship already built at the present time; you have to place an order for it, and wait until it is built. Owing to the demands of the Government throughout the country, shipbuilding is not going on as expeditiously as in normal times, in addition to which the engineering departments are very full. You have to pay so much down when you make the contract, in order that the person who builds the ship may buy the raw material, and, as he goes on building, you have to pay instalments of the purchase price. By the time we meet again I hope to be in a position to tell you that we have one, at any rate, of our new ships running. I have not yet dealt with the loan question, as I wish to explain that as a whole when discussing the increase of capital at the extraordinary meeting.

Professor H. Armstrong said he should like to take the opportunity of congratulating the Board on the great scientific advance made in recent times which distinguished them from every other gas company in the kingdom. Several years ago their late Chairman, Sir George Livesey, got the sulphur clauses removed, and he (the speaker) was one of those who deprecated that policy, as he thought that in the long run it would be detrimental to the gas interests. The quality of gas was consequently so affected that electric lighting gained a considerable advantage. This practically was the effect of the relief then gained—that gas went down in its purity, and many consumers had reason in their houses to realize the bad effects of sulphur compounds. He did not pretend to be a thought-reader, but he knew the Board set to work ten years ago to remedy the evil. It had taken a long time to accomplish the end; but it had been done towards the close of 1914, when the Board introduced a method of sulphur purification which stood alone on account of its excellence, and which system must at no distant date be adopted throughout the country. By this method the Company had recovered very largely the position of gas; and he desired to thank the Directors for the great advance thus made.

The Chairman: I thank you for your appreciation of the Board's efforts in the direction of purer gas. The task has been a thankless one; but when we have so high an authority as the last speaker commending our efforts, I am sure what we initiated a long time ago was a step in the right direction, and I feel confident it cannot but redound to the strength of the position of gas for all purposes.

The resolution was then put and carried unanimously.

The Dividend.

The Chairman: I have now to move:

> "That a dividend at the rate of £4 8s. per cent. per annum be now declared, and that the warrants be transmitted to the registered addresses of the proprietors by post."

Mr. John Mews: I have much pleasure in seconding the resolution. It has been suggested to me that six months ago I made some statement as to why the stock in this Company was lower than it had been at any time previously in its history. At that time the price was 83; the return on it being just over 5 per cent. To-day the price in the market is lower by 5 points—it is now 78; and the return upon that is about £5 12s. Perhaps you may ask me why did I tell you what I thought about things last year when now they do not appear to be as good as they were then; and I will therefore endeavour to explain. At that time 83 was the comparative price of the new war loan, which was issued at 4½ per cent. To-day the price of 78 is caused because the Government are issuing Exchequer Bonds which are paying 5 per cent. Of course, you cannot possibly expect that a Company like this can compete with a 5 per cent. Government stock; but you may wish to know that I do really think there is a glimmer of hope that the point we have reached in the price of the stock is more inclined to go up than it is to go down. I will give you my reason. Immediately the war started, the Government and the Stock Exchange arranged that certain gilt-edged securities should not be dealt in except at the price which obtained before the war. This in many cases has continued, and is continuing now. You know that people were not allowed to sell, or buy, Consols under 65. This minimum has been taken away, and the stock dropped at once to 58½. My own view is that, as soon as the other minima are taken off railway and preference stocks, our stock is bound to appreciate to some extent. You know the death duties are very heavy. Executors have had tremendous difficulty to raise money on estates; they could not raise it by selling railway debentures or preference stock, because nobody would buy them at the minimum price. When the minima come off, a large number of people have to come in and sell who have only been able to pay the Government by borrowing at a higher rate of interest than what they are receiving on the stock; and they will be able to pay the Government out of the sale of debenture stock. What I wish to point out is that we and others have had no minimum placed upon our stock. We sold it simply for what we could get. If people have to pay large death duties, they try to raise the money. In many cases where they would prefer to sell railway shares or debenture stock, if they could have done so, they sold our stock; and this depreciated the market. As soon as you take off minimum prices from gilt-edged securities, the price of our stock will go up, as there will not be the same necessity to sell.

The resolution was put and carried unanimously.

Re-election of Directors and Auditor.

The Chairman: I have now to move "That Mr. Frank Bush be re-elected a Director of this Company." I need not enlarge on the valuable services Mr. Bush has been able to render to the Company for so many years; but I can assure you that he is in every way a valuable and (if I may say so) necessary colleague.

Mr. K. P. Hawksley: I have much pleasure in seconding the motion.

The resolution was passed unanimously.

The Chairman: I now beg to move: "That Mr. Frank Harding Jones be re-elected a Director of this Company." I need not say anything with regard to him, except that his special qualification, apart from being an able business man, is of great value to us—I mean with regard to gas supply.

Mr. Hawksley: I beg to second the resolution.

The motion passed unanimously.

Mr. Frank Bush: I thank you for this renewal of your confidence. We are passing through very anxious times, and I desire to act with my colleagues in assisting the Chairman to deal with the many and complex questions which must necessarily arise.

Mr. F. H. Jones: I thank you for re-electing me a Director of the Company. It is a great honour, as well as a pleasure to be on the Board and to work with my colleagues.

Mr. T. S. Soden, having been unanimously re-elected an Auditor of the Company, briefly returned thanks for his re-election.

Extraordinary Meeting.

The Secretary having read the advertisement convening the meeting,

The Company's Bill Explained.

The Chairman said: I now rise to explain the reasons which have decided the Board to promote this Bill, and I will later move a formal resolution for its adoption, and then ask Mr. Browne, our Parliamentary Agent, to explain the drafting of the Bill in order to show how the intention is to carry out its objects. Those of you who are in the habit of following the reports of these shareholders' meetings will have noticed that it has been customary with me to deal generally with our business during the period under review, and not to weary you with many of the ups-and-downs of various items in the accounts which are more often matters of detail than of principle. I must, however, make an exception to the rule in dealing with the proposals of the Board for increasing the capital of the Company, and the circumstances which have required them to ask your approval of a Bill in Parliament in order to carry out their proposals. The first question most of you would ask is, I think: "Why, if the business is practically stationary, is it necessary to issue new capital?" Well, our capital requirements may be divided into two parts. In the first place we have to provide money to purchase land on which to erect the apparatus necessary for the manufacture of gas and residual products, to lay down pipes in the streets, and to provide meters to enable the consumption of each consumer to be ascertained. Now, it is not for this purpose we require capital to-day. In addition, however, to what may be called our fixed capital, we have to provide floating capital before we can commence trading. Our most important requirement is, of course, coal. We are buying it all through the year, paying for it weekly as it is delivered to us. But a considerable time elapses before the money we have paid for coal comes back into our hands as payment for gas and residual products. To keep our business going we therefore require a certain amount of floating or liquid capital. The amount we require depends primarily upon the cost of coal. Suppose, for instance, we have to provide a working stock of 250,000 tons of coal paid for and laid down on our works. We should require for this use a floating capital of £125,000, if the value of the coal so stocked were 10s. per ton. If, however, coal rose in price to 25s. per ton, we should have to set aside £312,500 for the purpose. Similarly with our products. When coal is high, these generally follow suit. Take coke, for instance. Its fuel value is much the same as coal. If we have a stock of 50,000 tons, its value may be either £25,000 when coal is cheap, or £62,500 when coal is dear. And so on with other products. In addition to providing stocks of raw and finished material, we also have to give credit in respect of what we sell. Take gas, for instance. Suppose we provide 1000 tons of coal and convert it into gas. It may be three months before the account for it goes in, and another month before it is paid, although the coal was paid for within a week of its receipt. There is another important factor which comes in, and that is the larger and more costly stocks of meters, stoves, and fittings we have to keep, in order to satisfy the more exacting requirements of our consumers. At one time it was the practice mainly to order these from the manufacturers when the consumers wanted them. We have now to keep them in stock ourselves; for the consumers will not wait, but expect to have their orders satisfied quickly after they are placed by them with us. I think you will see from this that, while our business goes on without difficulty when prices are normal, we are faced with the need of greater capital when prices are high—in other words, we need more floating capital to meet our obligations. Our practice in the past has been to provide this by a loan from our bankers. Economically this practice was sound, as, instead of providing our own capital on which there would be interest charges to meet every year, we only borrowed when we wanted it, and paid interest for the shorter period. It is probable that we might have made no change in this procedure but for the war and the hardening of the financial position. Our bankers met us very fairly in the matter, and agreed to finance our requirements until such time as we were able to get parliamentary sanction to the issue of new capital; and this is the object of the present Bill. Whatever stock it may be considered desirable to issue, we ask powers to redeem it, because we do not want the continued burden of capital bearing a high rate of interest for an indefinite period. We want to redeem it when favourable opportunities arise. We follow in this respect the example of a Special Act of Parliament which was passed for this very purpose in the last session of Parliament. So far as our consumers are concerned, they will be no worse off by reason of the money we require being obtained by a legalized issue of stock instead of by a loan from our bankers. Nor will present shareholders be seriously affected; for we shall probably pay as interest on the stock little, if anything, more than we pay now on bankers' loans. But we shall be in a legalized position, instead of one of uncertainty which may be open to question. The proposals of the Board must not be taken as any departure from our practice for many years in keeping our capital account as low as possible; for this is conducive to good working and strengthening the Company's position. For this reason we shall redeem what issues we may make as rapidly as possible. I may put the matter in another way by referring to some figures in the balance-sheet for the three years 1905, 1910, and 1915. The cost of our coal stock at the end of December was as follows: 1905, £60,170; 1910,

£149,560; 1915, £250,000. Coke—1905, £4600; 1910, £7200; 1915, £60,800. Tar and tar products, £55,000 in 1905, £40,000 in 1910, and £73,000 in 1915. Meters and stoves in 1905 £76,500, in 1910 £111,000, and in 1915 £148,000. Or, if I add the three figures together, the value was £197,000 in 1905, £308,000 in 1910, and £532,000 in 1915. Our outstanding accounts also come into question on these particular dates. In 1905 £313,000, in 1910 £295,000, and in 1915 £334,000. Coke products: 1905, £40,000; 1910, £46,000; and 1915, £150,000. Sundries, £9000, £24,000, and £20,000. The total of these items is: For 1905 £362,000, for 1910 £367,000, and for 1915 £509,000, or a total for the two together of £559,000, £675,000, and £1,041,000. This question does not affect our stability as a going concern at all; it simply means we want more capital owing to the greater cost of raw material. I do not know whether I have made the matter clear to you. If not, I shall be pleased to answer any question that may be put to me.

A Shareholder asked what was the increase of capital in the three years referred to in proportion to the increase of the stock.

The Chairman: In 1905 the capital was £419 per million cubic feet of gas made; in 1910, it was £423; and in 1915, £414. The capital has practically kept up with the increase of business in the past ten years; but, speaking generally, we have been able gradually to reduce our capital charges per million cubic feet of gas made in spite of the fact that our business is getting more complicated by reason of increased obligations to the shareholders. Does that answer your question?

The Shareholder: Not quite; what I wanted to know was in relation to the stocks in hand.

The Chairman: I have given you the stocks for the three years, and I can give you the amount of money raised.

Another Shareholder asked whether, considering the importance of gas residuals, it was the intention of the Board to allocate any portion of the money to research treatment.

The Chairman: I will answer that question when I have replied to the other shareholder. In 1905 our capital figured at £5,096,000, in 1910 £5,328,000, and in 1915 £5,476,000.

A Shareholder said there was no doubt the Company would require fresh capital. The Directors had decided that, and he was perfectly sure the large number of shareholders present that day would endorse the policy. But the question was: How are you going to get the money, and what amount do you want? The last loan was not offered to the shareholders, as was explained at the time; but he had no doubt on this occasion it would be obtained on good terms. He wished to know whether the amount called up would go to lessening the bank debts or in paying for coal.

The Chairman: With regard to the question as to research treatment of residuals, I may say we can do this out of revenue. As to the allocation of the new capital, it is wanted to pay off our bank loan. I now beg formally to move:

> "That the Bill now submitted to this meeting, intituled 'A Bill to authorize the South Metropolitan Gas Company to raise additional capital, and for other purposes,' be and the same is hereby approved, subject to any amendments which may be made therein by Parliament and approved by the Directors."

Mr. K. P. Hawksley seconded the motion.

Mr. Soden said as the Bill would enable the Company to raise additional capital, could not a definite amount be inserted?

The Chairman said this was dealt with in the Bill.

Mr. Brown (the Parliamentary Agent) said: The Bill before you to-day is a very short one, as it is confined to the financial position; the first object being to increase the capital and the borrowing powers—to improve the conditions under which the Company are obliged, owing to the provisions of the Act, to issue new capital, and, next, to exercise the new capital power by the issue of redeemable stock. These three objects form mainly the body of the Bill. The first clause is the common form clause, giving the Act a formal title. Clause 2 applies to the financial provisions of the Bill—to certain clauses contained in the Companies Clauses (Consolidation) Act, 1845—that being a convenient form of applying to the Company provisions relating to their obligation which are applied to all statutory companies. The third clause is the declaration of the present capital and borrowing powers of the Company. The reason for this clause, which is not customarily a clause appearing in a company's capital Bill, is plain—it is considered desirable to wipe-out the existing provisions of the Act relating to capital and start with a clean sheet. The fifth clause is an additional capital clause—that the Company may raise from time to time additional capital not exceeding in the whole £1,000,000. This clause enables you to raise £1,000,000. You have power to raise by the issue of ordinary stock £81,358. This sum will be wiped off, and you will begin with your new capital power of £1,000,000; so that the actual net new power conferred by the Bill will be £918,642. Clause 6 enables the Company to borrow on mortgage any sum not exceeding one-third of the amount of money raised by the issue of ordinary capital. This is a common form clause; but it has not appeared in your financial Act for some little time. Before the Act of 1882 you had power to borrow money on mortgage of the undertaking; but in that Act you abandoned this power, and confined your power to raising money on debenture stock. In these times of financial stress it is thought desirable that every available means of raising money shall be open to the Board; and for this reason it is suggested the Company should resume the power they formerly possessed. This sum will be limited to one-third of the money raised on ordinary stock. The limit will be £333,333. There, again, this will not be in addition to the powers you have to-day, as you have an unexercised balance of borrowing power of £162,728. The net new powers of borrowing are £170,605. Clause 7 is a common form clause authorizing the issue of debenture stock in substitution for the powers of borrowing on mortgage. This does not give any greater or other power of charging the Company's undertaking. Clause 8 deals with provisions contained in the financial Acts of the Company, which are not wiped out of existence by clearing off the slate your unexecuted borrowing powers. The provisions of the Act relating to debenture stock are a little intricate, and on strict construction difficult to reconcile one with the other. That is one of the reasons it is thought desirable you should get rid of the intricate provisions contained in Acts built up during the last 73 years, and start with more beneficial financial provisions. So clause 8 proposes to dispose of the clause of the existing Act. Clause 9 deals with a matter which is familiar to most of you—what we call auction clauses regulating the mode in which you have to issue ordinary or preference stock. At the present time the course of procedure is this: There is power to the Company to offer the stock in the first instance to consumers and employees at the average market price for the month preceding the offer. It is obvious if the price of the stock is falling during the month preceding the offer the average price will be higher than the price at the end of the month, you may be offering it at a price which exceeds the price at which it could be bought on the market. Clause 9 proposes to improve this state of things by saying that the average prices shall be taken over the preceding fourteen days instead of a month. The next step is that all the stock has to be offered for sale by auction or tender at a reserve price which is not less than the nominal amount of the stock. It is impossible to get rid of stock at par at the present time. Therefore the clause provides that the reserve price may be such price as should be reasonably determined upon by the Company. This is in accord with the more modern provisions of the gas companies' auction clauses. There are other smaller points bringing the auction clause more up to date. Clause 10 deals with the important power of issuing preference or debenture stock in the form of redeemable stock, to which the Chairman has already referred. It follows in principle the precedent of numerous parliamentary companies. There are some eight railway companies who have obtained power of this kind, and at least one water company. The Company have no power to issue preference stock, and one of the provisions of the Bill is that preference stock may be issued for raising new capital. Clause 11 is a formal one which has to be inserted for raising capital—that the capital raised shall only be applied to capital purposes of the Company. Clause 12 provides for the payment of the costs of the Bill by the Company. It may be within the knowledge of some of you that in the course of proceeding with Bills presented since the commencement of the war, the Treasury have insisted on the insertion of a clause that money cannot be raised without the sanction of the Treasury. We have agreed to insert the usual form of clause. It is relevant to observe that the Treasury have already sanctioned the raising by the Company of a substantial sum in excess of the amount recently raised; so there is still a margin available, and we have little doubt the Treasury will recognize that margin as existing. There is one other slight point. The Borough Council of Lambeth asked for a minor amendment of clause 5—that the new stock should be subject to the sliding-scale provisions.

The resolution was put and carried.

The Chairman: That concludes the business of the meeting.

Votes of Thanks.

A Shareholder said they ought not to leave without recording their appreciation of the services rendered by the Directors. He knew something about gas manufacture and the difficulties connected therewith, and felt sure that were he offered £5000 a year he would not take over the responsibility.

The motion was seconded and carried unanimously.

The Officers and Staff.

The Chairman: On the part of the Board I thank you very sincerely for this recognition of our services. The position we hold is by no means a sinecure; but we have done our business to the best of our ability, and, whether we are at the end of a long lane or have still some further distance to travel, this resolution will be a support to us, knowing that we have the confidence of the shareholders. Before sitting down, I beg to move that the thanks of the meeting be given to the officers and staff, who, after all, are the responsible persons to carry on the business.

The motion, having been seconded, was carried unanimously.

The Secretary (Mr. M'Leod), replying on behalf of the staff generally, said they had worked splendidly, and he was sure each member would much appreciate the vote, and take it as an encouragement in the hard six months that was before them.

The Chief Engineer (Mr. G. M. Gill) said he felt highly honoured in, for the first time, replying on behalf of the engineering staff. As he only entered the service of the Company at the beginning of the year, he could not speak of the work done during the past half year. But he could speak of the obligations they had to meet during the present war: and he thought the general result of the Company's working was highly creditable to all concerned.

South Metropolitan Gas Bill.—At last Tuesday's meeting of the London County Council, a recommendation of the Parliamentary Committee to oppose the South Metropolitan Gas Company's Bill was carried by the requisite majority; the cost of so doing to be met out of the county fund.

Atherton Gas Stokers' Wages Advanced.—The gas stokers employed at the Atherton Gas-Works recently asked for an advance in wages to 5s. 4d. per shift of eight hours, and requested that their war bonus should be increased from 1s. to 2s. per week. At the last meeting of the Council, the application was granted.

Launceston Gas Company.—The annual meeting of the Launceston Gas Company was held on Monday of last week—Dr. W. F. Thompson (the Chairman) presiding. The report stated that increased prices had occasioned the Board great anxiety. Owing to the price of gas having been raised during the year, the dividend declared was at the reduced rate of 6s. 9d. per share.

Co-Ordination in Street Disturbance.—Mr. Charles Jesson drew attention, at last Tuesday's meeting of the London County Council, to the manner in which, he said, streets were constantly being broken up by local authorities and companies to lay mains, &c. Referring to a thoroughfare in Vauxhall, he stated that the road had constantly been broken up—the chief offender being the South Metropolitan Gas Company. Mr. R. C. Norman, as representing the War Estimates Committee, remarked that they had suggested that steps should be taken to obtain co-ordination of activities in this respect between public bodies and companies.

BRENTFORD GAS COMPANY.

The Half-Yearly Meeting of the Company was held last Friday, at St. Ermin's Hotel, Caxton Street, S.W.—Mr. Ralph J. Neville Neville, M.P., in the chair.

The Secretary (Mr. John T. Croxford) read the notice convening the meeting; and the Directors' report and the accounts were taken as read.

The Chairman, in moving the adoption of the report and accounts, said the year they had just passed through had been one of great stress and difficulty for all of them, and following, as it did, almost directly after the new Act of Parliament, which came into force on Jan. 1, 1915, the Board had a very anxious time. Probably those present would remember that the Company's new Act and the Declaration of War became accomplished facts at about the same time; so that the Directors had passed through an extremely trying period, just when the Company were starting a new and large venture.

FREIGHTS AND COAL PRICES.

The chief difficulty that had been encountered was with regard to freights, and the enormous increase that there had been in the price of coal. The cost of coal had increased about 28 per cent., which represented a very large sum indeed; and, so far as one could see, it was likely that there was going to be a still further increase in the course of the coming year. The accounts were, he thought, extremely satisfactory [" Hear, hear "]; and he felt sure that the good men and true who laid the foundations of this Company years ago—like the late Chairman, Mr. Howard C. Ward and Mr. Ulick J. Burke—would have experienced the greatest satisfaction and gratification in seeing how well the work done under their control was now bearing fruit. The actual cost of coal had been practically met by the increase in the amount received for gas, meter and stove rentals, and residual products. It was really astonishing to see that the two amounts came to within £300 of each other. The income was £32,449 more than in the corresponding period of the previous year; while the extra cost of coal amounted to £32,720. The Company had also, of course, had other difficulties to meet. It had been necessary to hold enormously large stocks of coal; and anybody who knew how hard it was at the present time to foresee the course of both markets and freights, would agree that the Board were right in keeping this large stock, though under existing circumstances the step was a much more serious one to take than when prices and freights were normal. Another difficulty with which their Company, along with other undertakings, had been confronted was a big increase in the cost of labour and materials; and there was also the fact that there was not a free market for raising capital, but they had to go to the Treasury and get sanction to do so.

EMPLOYEES AND THE WAR.

To add to all the other troubles, they had lost a large number of their men. The contribution which the Company had made to the service of the Crown was one of which all concerned had every reason to feel proud. Out of about 1500 men, 497 had actually joined the Colours; while 250 more had been attested. So that practically 45 per cent. of the employees of the Company were in one form or another at the service of the Crown. This, he thought, was a truly magnificent statement to be in a position to make. Of the number of men who had gone, the proprietors would be glad to hear twelve had been thought worthy of Commissions—which was a great honour to the men and to the Company—and two of them had gained great distinction. One of them, Lieutenant E. W. Bennett, had got the Military Cross, and the other, Sergeant L. A. Titcombe, had been awarded the Distinguished Conduct Medal.

ASSISTING THE GOVERNMENT.

Besides all the things he had mentioned, the Company had put themselves entirely in the hands of the Government to do anything that was desired of them; and along with other gas companies, they had taken up the extraction of toluol, which was a new industry from their point of view, and one about which he would like to say a word or two. The extraction of toluol from the gas made a certain amount of difference —not a very large difference—in the heating and illuminating power of the gas; and, in consequence of this, the Ministry of Munitions sent round to all the local authorities, and published in the Press, a request that the authorities would not be too careful in marking what was amiss with the heating or lighting qualities of the gas. In doing this, the Ministry intended, of course, to help the gas companies, by asking people not to be too critical, because the toluol was in extraordinary demand for the purposes of the country. In many cases, no doubt, it had had this effect; but in some instances the result had been exactly the reverse. There were municipalities who said: "If you are going to take all this good stuff out of the gas, and make an extra profit, how are you going to compensate us for what we shall lose? We require compensation." Now, he wanted to make this point quite clear. So far as any profit was concerned, he thought they might take it that there was none at all. In fact, the proprietors could see proof of this, if they wished, in the accounts that were now before them. Under the heading of tar, it would be noticed that the increase in the amount of money they had received was only £35, although the quantity of tar made was substantially in excess of that made in the corresponding period of the previous year. This showed that there must be a considerable loss in connection with the toluol. However, the real fact which emerged was that, so far from the Company allowing their gas to go below the standard, they had enriched it, and had kept it up to the full statutory quality provided for in their Act. So far from the local authorities and other consumers having any grievance against the Company on the score of the toluol, the boot was, if he might say so, on the other leg. The Company had maintained the full statutory quality of the gas; while the shareholders, he was afraid, would look in vain for any profit in regard to toluol. Really, he did not think the Company had been treated quite fairly by some of the municipalities—who rated them, and some of whom competed with them by being the suppliers of electric light.

THE INCREASED PRICE OF GAS.

The Directors had, as would be seen from the report, increased the price of gas, as from Christmas last, 2d. per 1000 cubic feet. It was 24 years since the Company had raised the price of gas; and this, they would all agree, was an extremely creditable record. They were now the third largest Company in the London area; their output coming above that of the Commercial Gas Company, and next to that of the South Metropolitan Company. In the period he had named, they had never had occasion to raise the price of gas; but now it had become necessary. The future was full of uncertainty; and nobody could see what was going to be the condition of the tonnage and freight market, which at present was at a prohibitive level. In addition, there were the increased expenses in raw material, and in the cost of repairs, and other matters of this sort. However, he thought their rise in price was the smallest of any Metropolitan Company. It had also been longer delayed than the others; and he hoped it would see them through. So far as the shareholders were concerned, they were in rather a good position, because they had not been receiving the full amount of dividend to which they were entitled. The Company might have paid the amount of dividend allowed for an extra 1d.; so that now the shareholders would only be affected to the extent of 2s. and 2s. 6d. on the "A" and "B" stocks. He hoped that it would not be necessary to make any further increase.

THE ACCOUNTS.

Turning to the accounts, it would, of course, be seen that there were differences between the present ones and those for the corresponding period of the previous year. He had referred to the additional cost of coal being practically balanced by the extra receipts. Then there was the item of wear and tear, which was rather more on this occasion. The figure was £1664 up. The fact was that the half of the year now being dealt with was always an expensive one in this respect. There was also included in the item on the present occasion the toluol extraction plant; and there was the increase in the prices of materials. Therefore the figure in the accounts seemed to be quite a fair one. There was no other figure on the expenditure side of the revenue account with which it was necessary for him to deal, until he came to the items active service allowances and war bonus. These were new, and together they amounted to £9392. As against this, if the proprietors would look at the savings that had been made under the head of distribution—salaries and wages, and repairs and renewals of mains, meters, and stoves—they would see that there had actually been a saving of £9393; so that the new items on the one side and the savings on the other practically balanced—they were within £1 of each other. This spoke volumes for the skill of their Engineer and Manager (Mr. A. A. Johnston) and other officers, to whom they owed so much at the present time. The next items were in favour of the account, as compared with the corresponding one. On parliamentary charges there was a saving of £4780; and management cost about £700 less, due to the fact that now the other Companies who were amalgamated had come in, and there had been certain savings on salaries.

A YEARLY MEETING.

Before leaving this portion of the accounts, he might refer to the notice in the report about holding only one general meeting of the proprietors each year. Now, the amount of surplus they had in the June half year was £11,212; whereas on this occasion it would be noted they did not make the dividend and interest by £7720. There was thus a difference between the two half years—though both were equally skilfully managed—of nearly £19,000; and if they put the two together, they would see that there was really a surplus on the year's working of £3492 over the dividend. To obviate the difficulties that arose both on the Stock Exchange and in other places where these things were looked at, they proposed to have only one meeting of proprietors annually. People who might think the Company were doing very badly with a deficit of £7700, would forget that there had been a surplus profit in the first half year of £11,000; and so the shares might be affected. In having one meeting, they would be following in the footsteps of the railway and other great companies. It would not affect the question of interim dividends, nor the auditing of the accounts. There would be exactly the same accounts; but they would not be published. For any shareholder who wanted to see them, however, they would be available.

AN INCREASED CONSUMPTION.

The profit and loss, which was the next account, explained itself; and he did not think there was anything arising out of it. Certain amounts had been written-off investments, which was due to the Official Auditor. The special purposes fund had also been written-down to a better level; and, according to the Official Auditor, they would have to write it down still more. There was an increase in the quantity of gas sold of nearly 4½ per cent., which was very satisfactory; and there was also an increase in the number of consumers in the old Brentford district of 2 per cent. If the Company had the capital, and it was not war time, the proprietors would see a very large increase both in the number of consumers and in the make of gas; but the Board had to husband their resources, and therefore they did not undertake any more new construction work than was absolutely necessary. In fact, the Government refused to allow them to. From the balance-sheet, it would be seen they had an overdraft of £12,000, even with the £143,000 subscribed by the shareholders, which was one of the most successful financial operations the Company had ever conducted. It had been accomplished without any payment to a financial house; and the confidence of the shareholders could not have been better expressed than by giving the Board £143,000 out of the £150,000. The balance was being absorbed in small amounts; and he felt sure that very shortly there would be none left. On the credit side of the balance-sheet, stocks figured at £124,943, which was about £23,000 more than for the corresponding period. In addition, there were gas accounts due to the Company amounting to £86,000; and there was outstanding a sum of practically £228,000, which was a very large sum, when the capital of the undertaking was considered. This was where the difficulty came in—floating capital; and every gas company had found the trouble of that. It was adding to the cost of carrying on the business. The expenditure on capital account during the past half year amounted to £11,358, which was practically all dividend-earning—mains, stoves, &c.

A LOW CAPITAL.

He thought they would be glad to know that the capital per 1000 cubic feet of gas of this Company still remained within a fraction of a penny of what it was before the £143,000 was issued; and he believed it was to-day the lowest capital per 1000 cubic feet of any Metropolitan Company. This position was a great source of strength to the undertaking, and was one of the things on which his predecessors in the chair had laid the greatest stress. He congratulated the shareholders upon the position the Company occupied to-day, and the way in which it had borne the strain of a very difficult year. So far as he could see—though there were great difficulties ahead—if they could continue to carry on the way they had during the past year, the Directors would not be ashamed to meet the proprietors twelve months hence.

Sir Robert Shafto Adair, Bart., formally seconded the motion.

Expressions of Approval.

Mr. A. B. Bosher congratulated the Board upon the very excellent report, and the Chairman upon his illuminating address. Considering the terrible times they were living in, it was somewhat remarkable that the Company should have been able to show an increase in gas sold of 4½ per cent. He was fully in agreement with what had been said as to the holding of annual meetings. Not only would this course save both money and time, but it was also falling into line with the railway companies. It would not disturb in any shape or form any monetary or market operation that might take place in the stock. Gas and all other undertakings, in fact, whose principal usable article was coal were now passing through a very severe crisis; but it had to be faced, and he had no doubt with the skill and care which had always been exercised in the management of the Company they would pull through with the least possible inconvenience. At any rate, he felt, as an old shareholder, that the proprietors were most excellently served both by the Board and the General Manager and staff. Not only were the Directors men who were thoroughly devoted to the Company's interests, but what was of equal, or even greater, importance, they were a capable, shrewd, and level-headed body of men.

Patriotism of the Gas Companies.

Mr. H. D. Ellis, referring to the stock of coal, said he was sure that he and all present who were practically associated with gas companies would entirely concur in the views of the Board that it was absolutely incumbent upon them to see that they did not fall short in their stock of coal. They were to be congratulated heartily on having provided so well for this. As to the capital, he was much pleased to hear the remark that the Company still retained their pre-eminence among Metropolitan and Suburban undertakings, and by a very substantial figure. He thought he was right in saying that their capital was only about £360 per million cubic feet of gas. This was a position which neighbours might well envy them. The percentage of employees who had responded to the call on them constituted a splendid record. The Chairman had stated that the Company were not likely to get a profit from toluol extraction. This, he was sorry to say, was the case. In fact, some neighbours, he believed, so far from realizing a profit, were making a loss; and he did not think that what the gas companies had done had been properly appreciated by the municipalities of London. They did not appreciate the patriotic action of the gas companies. Though, perhaps, these bodies were composed of sober, level-headed, business men, in respect to most of the commercial transactions of the world, it was only necessary to say "gas company" to many of them, and they saw red. One would never persuade them that a gas company was honest, much less patriotic. But he would like to go further. Not only had the gas companies been making toluol, at best at a bare profit, and probably some of them at a loss, but they had given an additional proof of devotion to their country, because, at the request of the Government, they had been supplying sulphate of ammonia at considerably below the market price. Owing to the scarcity of nitrate of soda and other fertilizers, the Government put it to the companies that they should restrict their general sales of sulphate, and reserve for the benefit of British agriculturists a certain proportion, in order to stimulate and promote to the utmost the production in this country of wheat, &c. He thought he might say they were selling in December sulphate of ammonia to the Government, or the Government's nominees, at a rate fully equal to £2 below the market price. The price to the Government was £14 10s. per ton; and he believed at some period of the time the market price was £16 10s. Was not this patriotic, and were not the companies entitled to pat themselves on the back?

The Chairman: You are below the mark. The market price was £17 10s. per ton.

Mr. Ellis (continuing) said he could only see one objection to yearly meetings—that they would miss each year one of these delightful gatherings. The present meeting was the most crowded he had seen; and he assumed that others had come for the same purpose as himself—to express not only their gratitude to the Board for the way in which they had managed affairs, but their heart-felt sympathy with them in the anxiety they must have undergone since the last meeting.

Mr. R. W. Edwards remarked that the position might be summed up in a few words—a capital ratio of between 7s. and 8s.; an increase in the sales of gas of 4½ per cent.; the increase in the coal account balanced on the revenue side; and the dividend for the year earned, with a balance carried forward. Such a situation required no further recommendation. It spoke volumes for the Company. He joined with the other speakers in congratulating the Board.

The report and accounts were then unanimously adopted.

Concluding Business.

On the proposition of the Chairman, seconded by Sir R. Shafto Adair, dividends for the half year ended Dec. 31 (subject to income-tax) were declared at the rate of 5 per cent. per annum on the preference stock, £5 12s. per cent. per annum on the "A" consolidated stock, and 5½ per cent. per annum on the "B" consolidated stock.

The retiring Directors (Mr. J. Milne Watson and Mr. William Mann) were then re-elected, on the motion of the Chairman, seconded by Sir R. Shafto Adair; and the Auditors (Mr. Monier F. Monier-Williams and Mr. Alfred Bevis) on the proposition of Mr. W. Edgar.

A hearty vote of thanks—proposed by Mr. J. Ennis and seconded by Mr. J. Reeson—was passed to the Chairman, Directors, and officers of the Company, for their conduct of the business.

The Chairman, in acknowledgment, remarked that they had lost a very large number of their staff; and there was nothing more pleasant than to reflect on the fact that many old men who had earned their retirement had offered themselves to help the Company in their difficulty. They were doing very good work; and so had the women who had come forward. Nothing but the very highest praise could be bestowed upon the manner in which the officers had worked. The Company was going to be one of the very best in the Metropolitan area. They had a large undeveloped district; and if they went on on the lines that had been laid down, the undertaking should occupy a pre-eminent position in regard to its stock and others matters, when once the public came fully to understand what the position really was.

The Service of the Country.

Mr. Ellis moved: "That this meeting records its hearty thanks for, and appreciation of, the services both of the members of the staff and of the workmen who have enlisted in the service of their country, and have done duty by sea and land, thereby covering themselves with glory; and expresses deep sympathy with the relatives of those who have fallen." He said he thought that every man who had fought in this war had become a hero.

The Chairman: 31 of our men have fallen.

Mr. Bosher, in seconding, said their hearts must go out in gratitude to these men, as they should do to all those fighting at the front.

The resolution was cordially passed; and the meeting separated.

SOUTH SUBURBAN GAS COMPANY.

The Ordinary Half-Yearly Meeting of the Company was held last Friday, at De Keyser's Royal Hotel, Victoria Embankment, E.C.—Mr. Charles Hunt in the chair.

The Secretary (Mr. Wilfrid Wastell) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

Coal Contracts and Deliveries—Present and Future.

The Chairman, in moving the adoption of the report and accounts, said: To begin with, I am very glad to be able to say that, unlike last year's experience, there has not been any difficulty worth mentioning with regard to coal supply throughout the winter which is now drawing to a close. This is largely to be attributed to the reduction of winter deliveries made possible by the exceptionally heavy stocks accumulated during the summer months; but it is also a great pleasure to be able to acknowledge the due fulfilment, notwithstanding occasional delays incidental to the enormous increase of railway traffic consequent upon military operations, of such current deliveries as had to be contracted for. This improvement in deliveries is a matter for congratulation; but when our thoughts turn—as they have to do at this season of the year—to the obtaining of fresh supplies, the prospect cannot be considered satisfactory. The increase of home consumption, and continued, if not increased, shortage of men at the pits, have not eased the situation; while as to prices, safety seems to lie only in the somewhat precarious operation of the Price of Coal Limitation Act. But it is only fair to say that, in the application of the Act to existing contracts, the Company have been fortunate in having had to deal with contractors whose recognition of the position enabled them to offer a comparatively substantial reduction from their contract price; and although the tonnage affected by the reduction does not happen to be considerable—the only contract concerned not being a large one—it is not on that account less pleasing to acknowledge the spirit in which we were met.

OVERSHADOWING FREIGHTAGE.

Just now, however, the cost of freightage almost overshadows all other questions in connection with coal supply—not only because it directly affects the cost of procuring seaborne coal, but also from its indirect effect on that of coal which is railborne. During mid-winter, freight charges returned to the very startling figures to which they rose about a year ago; as much as 16s. 6d. per ton having been actually paid—the present figure being about 15s. This compares with a cost in normal times of 3s. or a little less; while, under the present wholly abnormal conditions, the cost, according to very excellent authority, is not more than from 4s. to 5s. per ton. The difference between this and 15s. represents about 10d. per 1000 cubic feet of gas sold, quite apart from the exceedingly high price which has now to be paid for coal at the pit mouth. The Directors have, therefore, felt it to be incumbent upon them to represent to the Board of Trade the great gravity of the position, having regard to its very injurious effect upon all interests concerned. I am sorry to say that, so far, no remedial measure has resulted from this representation; but we are not without hope that something may be done by the Committee which was recently appointed to consider the question. It is scarcely conceivable that there is no remedy for a state of things which, it is no exaggeration to say, spells "disaster;" that no sort of Government control is practicable. But supposing this to be unfortunately the case, at the very least it can hardly be beyond the power of the Government to give up to the consumer the share of the excessive charges which is to come to them as taxation of war profits. This would be a much more justifiable course than to inflict it upon the consumer—for it has to be passed on to him—at the very time when he is being urged by the Government to burn more gas. Moreover, it will hardly be denied that excess profits made at the expense of the consumer, whether it be of gas, electricity, coal, or provender of any kind, are in a different category from those which are derived from trades or manufactures directly arising out of the war; and, inasmuch as they may entail real hardship, ought, as far as practicable, to be returned to their source. There may be difficulty in doing this in every case; but hardly in that of the gas consumer, since such portion of excess profits as may be handed over to the gas undertaking by which he is supplied would for the most part, by the operation of the sliding-scale provisions, automatically reach him.

POSITION OF RESIDUALS.

The coal bill for the half year is, as was to be expected, the heaviest recorded in the history of the Company, although helped by remainders of contracts for both coal and oil at lower prices than those which are now ruling. Fortunately, there is a fairly substantial set-off in the increased receipts for residuals; coke in particular showing a remarkable recovery from the depression which prevailed during the corresponding period of the previous year. The effect of this recovery is highly gratifying, as evidence of the elasticity of this source of revenue even in what may be fairly described as mainly a residential area, the needs of which as regards coke supply are of themselves insufficient to keep the yards clear, and have to be supplemented by those of customers at a distance. A good deal of difficulty has been experienced this winter in reaching these customers, owing to congestion of railway traffic. There has also been difficulty in delivering by road, in consequence of scarcity of conveyances. Nevertheless the yard and road sales show a very satisfactory increase over those of the previous year. It is, I need hardly say, particularly desirable to foster such sales, as being very largely among householders; and the leaflet issued last autumn by the Parliamentary War Savings Committee, urging the use of coke in households as a substitute for coal, came as a very welcome support to the efforts of the Company in this direction. The circulation of this leaflet throughout the Company's area of supply was at once undertaken, and, it is believed, with beneficial effect. The advice given in it is so much to the point, and is, moreover, so entirely borne out by experience, that I do not make any apology for repeating, it in the hope that proprietors may be able to assist in extending the use of this fuel as recommended. It is simply as follows:

> Coal and coke mixed in equal proportions give a fuel which will last longer than coal alone. Though the fire will not blaze to the same extent, it will give a steady red-hot fire.

The bye-product which is next in importance—namely, ammonia, in the form of sulphate—has also much improved in value; the price now ruling for it being the highest reached for more than thirty years. This is accounted for by the absence of German competition; difficulty in obtaining nitrate of soda, owing to scarcity of shipping; and Government requirements for munition purposes. The endeavour which is now being made by the Board of Agriculture to extend the use of this fertilizer by British agriculturists gives, it is to be hoped, good promise for its future. This will receive our hearty support, even though the pecuniary advantages of the home market may not become immediately apparent. It is indeed high time that the economic superiority of this home product should prevail over the foreign product which has hitherto been so largely used. It seems a little strange that of the three principal bye-products of gas manufacture, the one which is most in request for supplying the very urgent needs of the time is also the only one which has not, to the ordinary producer of it, improved in value since the outbreak of war. Not only so, but the demand for tar, which is the bye-product in question, is diminishing rather than increasing, consequent, appparently, upon the difficulty under existing circumstances of dealing with the solid residuum—pitch—resulting from its distillation. It is not easy to understand why, this being the case, greater effort is not being made in the manufacture of the briquettes (composed of coal dust and pitch as the binding material), the use of which is also, as well as coke, recommended by the Parliamentary War Savings Committee as a substitute for coal. One would have thought that so promising a means of eking out the present scanty supply of coal would, in this time of national stress, be worked, so to speak, for all it is worth. Anyhow, the tar distiller is badly in need of additional outlets for his large and increasing stock of pitch, which, although possessing economic value, is at the present time practically unsaleable, and threatens by its accumulation to interfere with much desired development in other directions. Possibly more may be heard of a recent proposal to utilize it for gas making mixed with coal. There is one outcome of the necessities of the times, which may ultimately lead to more being done in connection with the working-up of residuals *in situ*. I refer to the dehydration at the gas-works of tar intended to be used for road purposes, by which most of the light oils are secured for further treatment and extraction of toluol, instead of being wasted, as is the case when crude tar is prepared for use at the roadside. Thus in many cases where the only idea has hitherto been to sell the crude product to the best advantage, the first step in its distillation is now being taken, perhaps to be followed by a more complete process on the return of normal conditions.

FINANCIAL RELATIONSHIP OF RAW MATERIALS AND RESIDUALS.

As in the expenditure for coal, so also in receipts for residuals, this half year establishes a record. They amount to £57,888, and exceed those of the next highest, which are for the second half of 1912, by £3392. For the latter period, however, the coal bill was less by £30,057—a difference between the two periods of nearly 7d. per 1000 cubic feet, which practically represents the present increase in the price of gas. In fact, anyone who cares to follow from half year to half year the figures relating to cost of coal on the one hand and receipts for residuals on the other—noting carefully the proportion which the one bears to the other—will be following very closely indeed the varying fortunes of this undertaking. If one may judge from the experience of the last seven years, he will soon find for himself how very varying these fortunes are; for during that period alone, the proportion which receipts for residuals has borne to cost of coal has ranged between 48 and 90 per cent. In the present half year, with figures for both coal and residuals higher than ever before, the cost of the raw material has only been covered to the extent of about 55 per cent. by sales of bye-products.

OTHER FEATURES OF THE ACCOUNTS.

It was quite to be expected that in other directions working expenses should show substantial increases, since materials of all kinds are now costing much more than in normal times. Nor will the proprietors, I feel quite sure, be in the least disposed to grudge the expenditure of £4677 on war bonuses and allowances—an amount which, by the way, is likely to be considerably exceeded in the current year. What all are much more likely to regret is the reduction of bonus payable to copartners by no less an amount than £1400. This reduction follows upon the increase in the price of gas, which, operating as it has done throughout the whole of the half year, has brought in about £25,000, or somewhat less than the amount of the statutory dividend of £4 16s. 8d. per cent., which, as proprietors are aware, is also governed by the price of gas, and is reduced accordingly. This dividend—which is at the same rate as last half year—if approved, will, with the help of the Company's bankers, be paid at the usual time; and I may take the opportunity of pointing out that the position in this respect—namely, the increased indebtedness to the bank as shown by the balance-sheet, of £70,000 as compared with £65,000 a year ago, or with £25,000 last half year—is primarily due to our exceptionally heavy stocks of coal and oil at war prices. The total of all the stocks is larger by £28,536, as compared with that of a year ago, and by £20,329, compared with that of the previous half year. It may also be pointed out, as accounting for an inevitable increase of indebtedness in the second half of the year, that, during this period, only the gas-rental for the two summer and lighter quarters is available for collection; whereas the first half of the year gets the advantage of the larger collections for the two winter quarters—the difference between the two collections being very considerable. This temporary addition to the working capital—for it may only be temporary—is not to be regarded as indicating a less favourable financial position, which it is our aim to strengthen as much as possible. It will be recollected that the possibility of converting the Company's investments in Consols into War Loan Stock was considered when the conversion scheme was first made public, but was not at that time found to be practicable. Since then market conditions have intervened, and, as will have been seen from the report, the conversion, which should result in an increase of revenue, has now become an accomplished fact. Other investments, much smaller in amount, have at the same time been written-down, so that the amounts now standing to the credit of the two funds respectively represent as nearly as possible market values.

THE GAS BUSINESS AND WAR REQUIREMENTS.

Having regard to the almost complete discontinuance of both public and outside shop lighting, shorter hours generally, and the undoubted exercise of economy by many private consumers, an increase notwithstanding of about 1 per cent. in the gas sales can hardly be considered as unsatisfactory; for it shows that, even in spite of particularly adverse conditions, gas, owing to the great variety of uses to which it may be applied, is capable of holding its own. Indeed, the development of the undertaking continues to proceed apace, the number of consumers added during the half year having been greater than the average of the two preceding half years, although, owing to the operation of the slot-meter system, which brings in a large number of comparatively small consumers, we are sharing the common experience that increase in the numbers of consumers means a reduction in the average consumption per consumer. Thus, with an addition during the last three years of upwards of 10,000 new consumers, or 17 per cent., there has been a falling-off in the average consumption per consumer of about 10 per cent. A further indication of continued development is the large number—3393—of cookers, fires, and other heating appliances added during the half year. For these, the demand has continued practically unabated; ability to supply having, however, been somewhat hampered by difficulty in obtaining, and also by shortage of men to fix, them. Here again we have to thank the leaflet to which I have already referred—this time for a recommendation to the public to "use gas whenever possible for cooking purposes." Notices have also appeared recently in the Press urging the more extended use of gas for both lighting and heating as "a patriotic duty." All these recommendations are with the object of saving coal and of securing an increased supply of the bye-products on which so much of the success of the war depends; and they testify to the economic advantage of the treatment of coal as practised by the gas manufacturer. As you are no doubt aware, efforts are being made throughout the country to obtain from the gas-works as large a supply as possible of these bye-products; and in these efforts, I feel myself free to say, our much esteemed colleague, Mr. Carpenter, has taken a very distinguished and successful part. But this great contest of resources in which the Allies are engaged demands more, and always more, of the materials by which alone it can be brought to a successful issue. Hence the appeal of the Government to householders to use less coal and more coke, or gas, or both, so that the gas-works output of residuals may be thereby increased. There can be little doubt as to what the answer to this appeal will be, when once it is realized how much depends upon it. But it is to be hoped the Government will do their part by bringing down freight charges so as to make it possible to continue to supply gas at reasonable rates.

LOYALTY TO COUNTRY AND COMPANY.

There is one other matter on which it is a great satisfaction to be able to dwell if only for a moment. I refer, as may be supposed, to the continued goodwill and loyalty of the Company's employees of all grades, which have contributed in no small degree to the smooth working of the undertaking in these exceptional times. We are all proud of the large number who are serving with His Majesty's Forces; and I may take this opportunity of saying that the Directors had great pleasure in carrying out the suggestion made at the last meeting to send to each of them a Christmas greeting and gift, in acknowledgment of which many appreciative letters have been received. The point, however, that I should like to make is that the withdrawal—I hope but temporary—of so large a number as stated in the report, and whose replacement for the time being is a matter of very great difficulty, adds considerably to the work and anxiety of many of those who are left behind; and it will be readily understood that there have been times when the present all-round shortage has been greatly felt. So far, however, all obligations have been fully met with a readiness and cheerfulness which are most creditable to all concerned; and the Directors have much satisfaction in recording their appreciation of this effective and sympathetic co-operation.

Effect of Freights on Pitch Sales.

Mr. Charles Carpenter, D.Sc., in seconding the motion, said he was sure the proprietors were all very much indebted to the Chairman for the clear and lucid manner in which he had set out the results of the half-year's working, and had, in addition, ably elucidated those facts which appeared in bald form as figures in the balance-sheet and sentences in the report. The Chairman had properly drawn attention to the important question of freights; and it was this freight question that pervaded the whole atmosphere of gas making to-day. Mentioned also by the Chairman was the low value which was being received for tar, by reason of the fact that pitch was so largely a drug on the market. Pitch was badly wanted for briquette making by two of their Allies—by the French and by the Italians. He need not remind those who had travelled much on the Continent how largely briquettes were used both for locomotive and marine purposes. But the tremendous cost of freight (which was something like ten times the normal) made it practically prohibitive to export pitch now. Its value here—its intrinsic value—was high, because its worth was approximately proportionate to that of coal. But the whole difficulty arose from the fact that it could not be exported. He thought the Government were bound to take this matter in hand, because there were grumblings and discontent on, for instance, the part of the Italians, over the high cost that was being charged for freight; and the high figures that were being taken by the English shipowners (there were others as well) in the way of profit was being looked at by the Italians as being not altogether the best expression of brotherly affection. If the Government would only take this matter in hand, they would ease the situation enormously, and in the only direction in which he thought it was possible. The coal question was bound-up with that of the shortage of labour. This the Government had tackled by fixing a price beyond which coal charges were not allowed to be increased. And although the figures at which the charges stood were very high, yet they were much less than the prices at which the Company's requirements had been met, but which were considerably lower figures than the market price to-day to those who were not similarly placed. There was one other feature of satisfaction in the report. Despite the enormous reduction in lighting, owing to the restrictions on shop and street lighting, there was an increase of 1 per cent. in the quantity of gas sold. He mentioned this fact, because it reflected considerable credit upon the activities of the portion of the staff whose particular duty it was to extend their business as gas sellers. As the proprietors knew, the staff of a gas company was different now from what it was for very many years. They had not only a skilled organization to make gas, but they had to have a skilled organization to sell it. He thought it was very creditable that the consumption of gas had in these times increased even by what might appear the small amount of 1 per cent.

The motion was unanimously carried.

DIVIDENDS DECLARED.

The CHAIRMAN moved the declaration of dividends at the following rates per annum: 5 per cent. on the preference stock, 4⅝ per cent. on the ordinary stock, and 4⅝ per cent. on the West Kent ordinary stock, all less income-tax.

Mr. W. G. WALLER, in seconding the motion, took the opportunity of thanking the proprietors on behalf of the co-partners at the front for the presents sent to them at Christmas. From the letters received, it was seen that this little attention was greatly appreciated.

The motion was unanimously adopted.

FREIGHTS A QUESTION OF INTERNATIONAL IMPORTANCE.

Sir J. FORTESCUE FLANNERY, Bart., M.P., said it was a pleasure to move the re-election of the two retiring Directors—their Chairman (Mr. Charles Hunt) and Mr. Charles Carpenter. In doing so, he should like to re-echo the remarks of Mr. Carpenter as to the complete and lucid statement which had been made by the Chairman. The key-note of what the Chairman had said, and of what Mr. Carpenter had said, was the question of freights. This was a matter of the utmost international importance at the present time, and it was one which, unless grappled with, would increase in international importance, and perhaps have a more widespread influence than even its effect on the gas trade. It was nearly eighteen months since he, for one, as interested in the gas industry, raised the question of freights in the House of Commons; and the immediate result of the question being raised, by others as well as by himself, was to produce some influence by the Board of Trade, which did result for a time in an improvement in the freight arrangements from the coal trade point of view. Certain German ships which had formerly been lying idle after capture were released, and were used in relief of coal transport from the North to the southern gas companies and others. This was a palliative for a short time. The state of things, however, in respect of the carrying of coals, was now as bad as ever, and a great deal worse in some other trades. The Chairman had referred to the question of excess profits. This raised an important point, which even to the shipowners might lead to some concept, and then to some agreement with the views of users like the gas trade. The proprietors were aware that, under recent legislation, those who made profits greater than they made in times of peace had to pay one-half into the Exchequer under the guise of what was known as the excess profit tax; and some of the shipowners had very large sums indeed to account for to the Treasury—indeed, many millions would be collected by the Treasury from the mercantile marine of the country. Now the grievance of the British shipowners was that their competitors, neutral shipowners in Holland, Sweden, and Norway received the same high freights, with this difference—that the neutral shipowner was able to keep the whole of the profits arising from the high freights, whereas the British shipowner had to surrender one-half of them, by way of taxation, to the Government. The British shipowner realized that, when the time of peace and normal competition returned, the neutral shipowner would be subsidized by the accumulations of these large sums which he was able to keep in his own pocket, but half of which the British shipowner had to surrender to the Government. Therefore, he (Sir Fortescue) believed that, if the suggestion the Chairman had made was carried out, and the Government were to directly and definitely intervene in this question of freights, many of the British shipowners would welcome the intervention on the ground that it would restore in times to come equality and justice as between the British shipowner and the neutral shipowner. He hoped he had made the point clear, and had succeeded in interesting every one of his co-partners in the concern, so that they might use their influence in the direction indicated by the Chairman. One other point he would mention was as to the manner in which the bye-products had come to the rescue of the Company, in relief of the enormous increase in their expenditure upon coal and other matters. They should not let the gas consumer suppose that the whole burden had fallen upon him; on the contrary, he had only had, during the half year, to bear about half the burden in comparison with the increase of expenditure. Comparing the period just closed with the corresponding half of 1914, the increase in expenditure had been in round figures £47,000. Where had this £47,000 come from? Of it, £25,000 had come from the increased yield of the gas sold; and £22,000 of it had come from the increased yield of residual products. He emphasized this point, if he might be allowed to do so, because he wanted the gas consumer to realize that the Company had only called upon him for little more than one-half of the extra expenditure. Before moving the resolution as to the retiring Directors, he wanted to speak of two other colleagues. They had with them that day for the first time Sir John Boraston. They used to have Mr. Boraston with them, and had always welcomed him. As Sir John Boraston, they were still glad to see him in his accustomed place, and were pleased to be able to congratulate him upon the well-deserved honour which His Majesty had placed upon him. [Hear, hear.] Then Mr. Alexander Dickson was unfortunately absent through illness; but he hoped to resume his duties at the next Board meeting. As to the retiring Directors, they had in Mr. Hunt and Mr. Carpenter two of the most successful and distinguished gas engineers that the gas profession possessed, and in this they were exceedingly fortunate. It was a privilege to move their re-election.

Mr. B. R. GREEN, in seconding, said the proprietors, in passing this resolution, would be promoting the best interests of the Company, particularly at a time like the present, when difficulties and problems the like of which had never been experienced before called for the most able guidance and control.

The motion was cordially passed.

The CHAIRMAN and Mr. CARPENTER having replied,

On the proposition of Mr. FISHER, seconded by Mr. R. GARRAWAY RICE, Mr. Samuel Wood, F.C.A., was reappointed to his office as Auditor.

Moved by Mr. C. E. NUTHALL, and seconded by Mr. GARRAWAY RICE, a hearty vote of thanks was passed to the Chairman and Directors, the Engineer (Mr. S. Y. Shoubridge), the Secretary (Mr. Wastell), their staffs, and the workmen. Mr. Nuthall also embodied in the resolution, that the heartiest greetings from the proprietors, and a wish for a glorious return home, should be sent to the employee co-partners at the front.

The CHAIRMAN, in the course of his reply on behalf of all included in the resolution, said that the desire of the proprietors regarding the men at the front should be complied with.

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NEWPORT (MON.) GAS COMPANY.

Moving the adoption of the report and accounts at the half-yearly meeting of the Company held on Monday of last week, Mr. George Green, J.P., expressed regret that the Chairman (Dr. H. M. Brewer, J.P.) was not well enough to be with them. Dealing with the business, he said, notwithstanding the mild winter, early closing, lighting restrictions, and the very few new houses that were being built, all classes of consumers for lighting, heating, power, and industrial works had increased their consumption by more than 7,000,000 feet over the corresponding half year, which was equal to nearly 4 per cent. Considering all things, he thought they would agree that this was fairly satisfactory Coals had cost £5100 more. Materials, wages, incidentals, separation allowances, and war bonuses had cost £2173 more. The consumers for a period of nine months had the benefit of coal contracts at pre-war prices. Then the Company were obliged to raise the price of gas 20 per cent., which was about equal to the increased cost of coal only, as the increased prices of gas produced £5277. Coal advanced in price by 70 per cent. when they made their last contracts; but the Price of Coal Limitation Act fortunately came to their aid and brought the figure down to 30 per cent., as against 20 per cent. increase in the price of gas. They hoped it would not be necessary to again increase the price of gas. They certainly would not if coal kept at its present rate. With regard to residuals, there were still considerable demands for shipments at better prices for coke, which, together with tar and ammoniacal liquor, showed an improvement of £3257. Coke sold for local domestic consumption in small quantities remained at the pre-war prices, in order to encourage the poorer people to use it as much as possible. The recovery of toluol retained its efficiency, thanks to their very able Manager, Mr. J. H. Canning, who introduced certain improvements that enabled him to get a larger percentage of this valuable commodity. In producing toluol gas companies obtained no financial advantage; but it was a patriotic endeavour to keep pace with the country's needs in the matter of high explosives. Following the precedent of last half year, when substantial amounts were written-off investments, the Directors had written-down the War Stock held by the Company to 96½ per cent., representing £538. He thought they would agree that altogether the revenue account was very satisfactory. They had cleared just enough to pay their statutory dividends, which was not so in previous half years of the war period. They carried to the profit and loss account £8570, against £7605 last year. He thought the Directors were justified in regarding the financial position of the Company as very sound. He wished to pay his tribute to the exertions of the staff during these troublous times to keep the works and the commercial side of the business in thorough working order, which had meant the closest attention. Mr. Canning, senior (the Engineer), Mr. Canning, junior, and Mr. T. H. Hazell (the Secretary) had had to work many hours overtime to keep pace with their difficulties.

The report having been adopted, and the statutory dividend of 5 per cent. per annum declared, votes of thanks were accorded to the Chairman, Directors, and staff. Responding, Mr. Hazell said the Board had made arrangements for the positions of the patriotic members of the staff who had gone to serve their country being reserved for them, if they wished to return at the close of the war. Mr. T. Canning remarked that he hoped the plant which the various undertakings had laid down for producing toluol would not be swept aside after the war. The material was the direct material prepared ready for the making of aniline dyes, an industry which the Germans captured from this country, and which this country ought to endeavour to recapture. He added, in reply to a question, that it would not be at all advisable for a company of the size of Newport to provide plant for the manufacture of dyes; it was a delicate and expensive process But inasmuch as the halfway house had been reached, and gas companies all over the kingdom were prepared to send out direct material for the manufacture of dyes, it ought to be very much cheaper than formerly for those who chose to go in for making the dyes. The suggestion of an association of producers was certainly practicable.

CAMBRIDGE UNIVERSITY AND TOWN GAS COMPANY.

A falling off of 4·8 per cent. in the production and sale of gas was announced by the Chairman (Mr. E. H. Parker) when presiding at the half-yearly meeting of the Company last Tuesday; but he added that, considering the times, the accounts must be regarded as satisfactory. A great deal of the lessened output was accounted for by the decreased street lighting and the number of houses that had been shut up. The other side to the question, he said, was the increased use of gas-fires, cooking-stoves, and appliances for heating water.

The profit from the sale of coke and ammoniacal liquor had increased; but the receipts from tar had decreased. There seemed to be considerable misunderstanding in some quarters as to the value of tar to-day. It was true the value of the lighter oils had increased; but when it was remembered that from 50 to 60 per cent. of the tar was composed of pitch, and that owing to the closing of the Belgian and French markets which were the main outlets, pitch was now a drug in the market, and only a very small proportion of it could be disposed of at all at the present time, it would be seen that the Company had not benefited. With regard to the production of toluol, the Company were doing all that was possible to assist the Government, and with this object in view had had to incur considerable outlay in providing the necessary plant at their own expense. The tar distillers, however, did not encourage them to believe that the profits from the toluol, &c., would compensate for the low value of the pitch. The illuminating power had not suffered to any appreciable extent by the process adopted to extract the toluol from the gas. It had been suggested that the price of coal had been reduced by the Limitation of Coal Prices Act; but here, again, there was a misapprehension, as the collieries were allowed by the Act 4s. per ton over contract prices for the period June, 1913, to June, 1914. But their contracts for 1913-14 were 1s. per ton over the 1914 prices. This meant that the collieries were allowed 5s. per ton over the 1914 prices, besides which they got 50 per cent. increase in the rates for waggon-hire. Consequently the Act failed to assist the Company materially. They had been in negotiation with the borough authorities with regard to the charge for public lighting, and had come to an arrangement which the Directors were given to understand was considered reasonable and fair. At any rate, the Board endeavoured to deal with the matter in a liberal spirit. The Company were again indebted to their Manager (Mr. J. W. Auchterlonie) and to the whole staff for the satisfactory results which had been obtained.

The report and accounts for the six months ended Dec. 31 were adopted; and the usual dividend was declared.

Extended Lighting Restrictions.

The Home Secretary has made an order extending to the central and north-western areas of England the restrictions on public and private lighting in force in the eastern and south-eastern counties. The restrictions had already been applied, on the advice of the naval and military authorities, to certain places of special importance in the Midlands, Lancashire, and the West Riding; but experience gained from the last Zeppelin raid shows that their extension over the whole of these areas is a necessary precaution. The order comes into force on the 16th inst.; but it is very desirable that in the meantime every effort should be made to comply with its provisions. Among the provisions are the extinction of all external lamps except such public lamps as are approved by the Chief Officer of Police, and the reduction of other lights to the minimum intensity consistent with safety. In case of sudden emergency, all instructions as to the further reduction or extinction of lights given by, or under the direction of, a competent naval or military authority or the Chief Officer of Police shall be immediately obeyed. The order shall apply as follows: From half-an-hour after sunset till half-an-hour before sunrise, in the portions of the counties of Northumberland and Durham to which the Lights (East Coast) Order does not apply, and in the Administrative County of the Soke of Peterborough. From one hour after sunset till half-an-hour before sunrise, in the portion of the North Riding of Yorkshire to which the Lights (East Coast) Order does not apply. in the West Riding of Yorkshire, and in the counties of Derby, Nottingham, Leicester, Rutland, Northampton (except the Soke of Peterborough), and Buckingham. From one hour-and-a-half after sunset till half-an-hour before sunrise, in the counties of Lancashire, Cheshire, Flint, Stafford, Warwick, Worcester, Shropshire, Hereford, Oxford, Berkshire, Gloucester, Wilts, and Dorset.

Bury St. Edmunds Gas Company.—At the half-yearly meeting of the Company, the usual dividend was declared; but the Directors' report contained an intimation that "the uncertainties of the future might make it necessary to re-adjust the dividend, or re-consider the custom of paying the dividends free of income-tax." The revenue account showed a balance of £1348; and the Chairman (Mr. T. Ridley) said they had on the half-year's working earned the dividend which they proposed to pay.

CONSOLIDATED GAS COMPANY OF NEW YORK.

Working Results for 1915.

On the 24th ult. there was issued a condensed statement of the assets and liabilities of the Company as at Dec. 31, 1915; also some very interesting particulars as to the working results of this huge concern for the twelve months.

ASSETS.	
Fixed assets, including land, plant, and equipment	$54,385,149·33
Bonds and stocks of, and advances to, Affiliated Companies and other investments	111,061,246·50
Bonds and mortgages	200,000·00
Cash	2,127,624·99
Accounts receivable	3,492,457·03
Material and supplies	996,081·29
	$172,262,559·14
LIABILITIES.	
Capital stock	$99,816,500·00
Convertible debentures	24,846,647·50
Accounts payable and accrued charges	3,676,687·19
Stock and bond premiums	13,951,396·99
Renewal and reserve fund	11,962,590·66
Profit and loss	18,008,736·80
	$172,262,559·14

The figures thus far available respecting the Company's operations for the year indicated that its earnings from its gas business (after deducting the reserve for renewals and contingencies) amounted to $2,376,753·40. For the purpose of determining the earnings, applicable (in accordance with the decision of the United States Supreme Court) to the value of the tangible and intangible property ($80,258,978·54), employed in the Company's gas business, there should be added the net earnings of the Astoria Light, Heat, and Power Company, $1,145,467·11. This made the total net earnings from the Company's gas business for the year 1915, $3,522,220·51—an amount which is equivalent to 4·39 per cent. on the above stated value of the tangible and intangible property employed in the manufacture and distribution of the gas sold by the Company.

Dividends were paid during the year on the Company's capital stock, aggregating 6¾ per cent. (at the rate of 7 per cent. per annum) and amounting to $6,737,613·75. The dividends and interest received on stocks and bonds owned and advances made to affiliated gas and electric companies, operating in the boroughs of Manhattan, Queens, and the Bronx, and also in the County of Westchester (excluding interest and dividends received from the Astoria Light, Heat, and Power Company, the net earnings of that Company being included above) amounted to $6,700,383·08. The interest paid during the year on the funded and other debt amounted to $1,719,745·66. Therefore the surplus (including that of the Astoria Company) to be carried to the profit and loss account for the year 1915 was $1,765,244·18.

Of the total authorized issue of $25,000,000 of convertible debentures of the Consolidated Company, subscriptions were received for $24,850,750. On Nov. 1, $1,236,000 of debenture bonds, 1888 issue (the balance then outstanding), were paid off. On Feb. 9, $2,500,000 of the Company's demand notes, issued in 1906 and 1907, were paid off. On April 25, $2,500,000 of eight months' collateral trust notes were paid off. On June 26, $7,500,000 of similar trust notes were paid off. The gas sales of the Consolidated Company fell off during the year, as compared with 1914, by 829,075,400 cubic feet, or 5·02 per cent. Its gas sales and those of its affiliated Companies in the borough of Manhattan fell off during the year by 1,230,034,900 cubic feet, or 5·38 per cent. In the borough of the Bronx the decrease in gas sales, due to the decrease in the consumption of gas per individual, was nearly off-set by the increase resulting from the development of building operations in the territory; so that the loss in the volume of sales amounted during the year to only 29,803,600 cubic feet, or 0·70 per cent. In Westchester County and in the borough of Queens—both of which are growing territories—the sales of gas increased during the year by 46,508,502 cubic feet, or 1·98 per cent. The combined sales of gas of the Consolidated Company and affiliated Companies in the boroughs of Manhattan, the Bronx, and Queens, and in Westchester County amounted to 1,213,329,998 cubic feet less than in 1914—a loss of 4·12 per cent.

For the purpose of ascertaining the real cause for the abnormal decrease in the consumption of gas in the borough of Manhattan, comparisons have been made between the variations in the amount of gas consumed in 1914 and 1915 in all classes of establishments—including dwellings, apartment houses, stores of various kinds, factories, hotels, and restaurants. These indicate that, except in the case of restaurants (which show an increase in consumption), the percentage of decrease in dwellings and apartments as well as in all classes of business has varied within a comparatively narrow margin between 2·50 and 9·63 per cent. For example, 5000 of the prepayment meter accounts show an average decrease of 3·65 per cent.; while 1000 miscellaneous stores show an average decrease of 6·49 per cent. An average decrease in gas consumption by 500 grocery stores in 1915, as compared with 1914 was 9·63 per cent.

Among the reasons assigned for the result shown are: The effect of the European war upon large and small manufacturing concerns, which are dependent on Europe for their raw material and have in consequence greatly reduced their output—resulting in a decrease in gas consumption; the growing popularity of moving-picture theatres, which operates to decrease the domestic consumption of gas for illuminating purposes; the ever-increasing use of electricity for such purposes as well as the growth of the use of small electric appliances, which supplant the gas-consuming ones heretofore used; the weather conditions during the months of January, February, March, November, and December, 1915, which were not favourable to the normal consumption of gas in these months; the policy of the Department of Water Supply, Gas, and Electricity, which has led to the displacing of a very large number of gas street lamps and the substitution therefor of electric lights; the practice of greater economy in the use of gas for illumination as well as for domestic purposes; and the growing popularity and use of incandescent gas-mantles, which, compared with the old-time flat-flame burners, combine greater illumination with diminished gas consumption.

During the year the Consolidated Company and its affiliated Companies installed 187,851 appliances, and there were surrendered to the Company 97,455—a net increase of 90,396 in the number of appliances in use, which had been installed by the Companies, as against a net increase the previous year of 61,570 appliances. The net increase in 1915 included 1582 hotel and restaurant appliances, and 3496 industrial appliances. On Dec. 31 the Consolidated Company and its affiliated Companies had under rental contracts 428,983 cooking appliances of various types—an increase of 19,920 over the number installed on Dec. 31, 1914.

Among the purposes for which industrial appliances were installed are included: Japanning automobile bodies; sterilizing milk bottles; lacquering display fixtures; firing china; heating doll-moulds; heating presses; reducing radium ore; supplying heat for the manufacture of paint, and also for the treatment of automobile springs; heating oils for compounding; applying heat to shrapnel shells; supplying steam for corrugating paper; dressing belts; treating with heat certain parts used in the making-up of electrical novelties; manufacture of dies; producing steam for heating acid baths; manufacture of drugs, face creams, soaps, and toilet preparations; supplying steam for cloth-sponging cylinders; the manufacture of millinery supplies; heating various oil baths; manufacture of ladies' hats; wholesale baking of veal-loaves, and also bread; and the smoking and curing of hams and bacon.

Last fall the Company inaugurated another lamp campaign to promote the "C. E. Z." incandescent gas-lamp. This lamp is said to be simple in construction, is equipped with three small mantles of great durability, and is the latest development in the art of incandescent gas lighting. It diffuses a soft, mellow light of high illuminating value. Its merits have evidently been recognized by the public, as over 100,000 have been sold since the campaign started. In the campaign two years ago more than 91,000 incandescent gas-lamps were sold.

The installation of two 72-inch gas-mains in the new Astoria Tunnel between Astoria and the Bronx was finished during the year; and the transmission of gas through these mains began on Oct. 1. Their installation marks the completion of comprehensive plans whereby the gas distributing systems in the boroughs of Manhattan, the Bronx, and Queens are connected in a manner which insures an uninterrupted supply of gas in the three boroughs supplied by the Consolidated Company and its affiliated Companies—thus conserving permanently the safety and convenience of the public.

◆

At the annual meeting of the Yeadon and Guiseley Gas Company, last Wednesday, it was reported that the profits had amounted to £3130. Dividends were declared at the rates of 10¾ and £7 10s. 6d. per cent.

MAXIMUM PRICES FOR SULPHURIC ACID.

A notice was issued last week from the Ministry of Munitions to all sulphuric acid makers and dealers fixing maximum prices for the sale of acid. These came into force yesterday.

The prices per ton for acid delivered into railway trucks, carts, or barges, at makers' works, are as follows:

—	Degrees Twaddel.	£	s.	d.
Class A.—Arsenical acid . .	140	3	0	0
Class B.—Dearsenical acid .	144	3	15	0
Class C.—Arsenical acid . .	168 (93-95 per cent. H_2SO_4)	5	15	0
Dearsenical acid .	168 (93-95 per cent. H_2SO_4)	6	0	0

Incidental charges are also to be regulated as under:

When the acid maker supplies the tank-trucks, he shall be entitled to make a further charge of not more than 5s. per ton for filling and hire of tank-trucks.

When the acid maker supplies the acid in his own drums, he shall be entitled to make a further charge of not more than 10s. per ton for filling and hire of drums.

When the acid is supplied in the acid makers' own carboys, he shall be entitled to make a further charge of £1 per ton for filling and hire of carboys. When carboys are supplied by the purchaser, it is recommended that a charge of 10s. per ton should be made by the acid maker to cover the cost of filling.

◆

THE EXPLOSION AT A BLACKBURN GAS-WORKS.

Result of the "Investigation" by the Trades' Council.

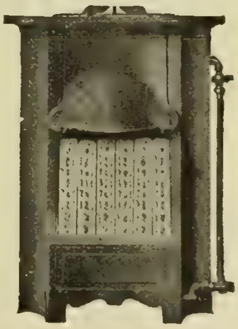
Further reference was made to the recent explosion at the Addison Street Gas-Works of the Blackburn Corporation at a meeting of the Trades' Council last Wednesday, when a report was presented by a Sub-Committee as to the cause of the explosion. At both the January and February meetings of the Town Council, Mr. E. Porter, the representative of the Gas-Workers' Union, sought to have an inquiry made into the cause of the explosion [see *ante*, pp. 100, 322]; but this has not been agreed to.

The Trades' Council report alleges that at a meeting of the Blackburn Gas Committee on Dec. 20 [four days after the explosion] the Mayor (Alderman Nuttall, J.P., who is also Chairman of the Gas Committee), in the presence of Mr. J. Johnson, J.P., and Mr. E. Porter, stated that he (the Mayor) with Mr. A. Morton Fyffe, M.Inst.C.E. (the Gas Engineer), had made inquiries, and were satisfied

The MAIN D.S.O. Fires

"DEPENDABLE."
(Reduced Type.)

"SYMMETRICAL."
(Reduced Type.)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The New Booklet contains particulars of Four different types.
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WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

that the explosion had been deliberately caused by workmen acting in collusion with some one outside the works. The Committee of Investigation emphatically declare, after a full inquiry, that—

1.—The explosion was not deliberately caused.
2.—There was not a particle of truth in the statement that a valve had been tied down with a rope.
3.—If one valve had been so tied down, as alleged, there being six valves in all, an explosion could not possibly have happened from this cause.
4.—The explosion was due to incompetency.

The report goes on to say the Sub-Committee consider that for the Mayor to make such a charge against the workmen of the character reported, and then to oppose an inquiry, was un-English. In common fairness, they must again press upon the Town Council their demand for the appointment of a public tribunal to go into the whole matter, so that the stain upon the honour of the employees of the ratepayers of Blackburn can either be removed or they can be proved guilty of the offence, and dealt with in a proper manner.

Mr. J. Frankland, J.P., who presented the report, said the Committee, in dealing with the matter, had endeavoured to get at the real facts; and the men they consulted were prepared to go before any Court or tribunal and stand their trial.

The meeting decided to ask the affiliated societies to the Trades' Council to appeal to the Town Council to appoint a tribunal for investigation.

◆

A "Bad Gas" Resistance League.—At a public meeting held at Brentwood (Essex) some days ago, a "Bad Gas" Resistance League was formed, the members of which pledged themselves not to pay their latest gas bills till these had been reduced to the same amount as last year. The assertion was made that "analysis had proved the gas to be largely composed of atmospheric air;" and on the Ministry of Munitions being communicated with, they had replied that "in no case had they advised gas companies to add air to their gas to make up the profits."

Derby Gas Consumption.—The 96th annual report of the Directors records that, notwithstanding an increase in price as from June last, and the restricted public lighting and hours of business, there has been a greater consumption of gas locally. For general use 1,071,778,400 cubic feet, and for public lighting 26,999,700 cubic feet, were sold, as compared with 1,038,210,600 feet and 42,501,000 feet in 1914. The total receipts were £114,810, against £104,575; but the cost of manufacture was £122,288, compared with £95,786 in the preceding period. The balance of revenue carried to profit and loss account is £34,498, against £33,158. An interim dividend of 5 per cent. per annum having been paid for the first half year, the Directors recommend payment of the standard rate of 5 per cent. per annum on the consolidated stock for the second half year, with an additional ¾ per cent. for the whole year, making 5¾ per cent., less income-tax.

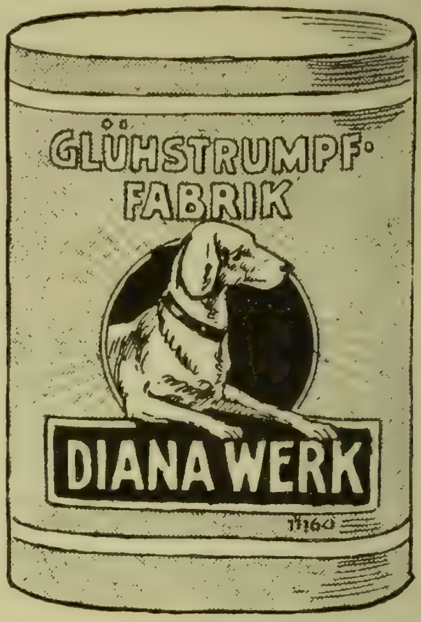
GERMAN GAS-MANTLES.

Government Supply to Labour Exchange.

[From the "Daily Mail," Feb. 10.]

An enterprising clerk in a provincial Labour Exchange made a curious discovery the other day. The Office of Works in London forwarded a fresh supply of incandescent gas-mantles for use at the exchange.

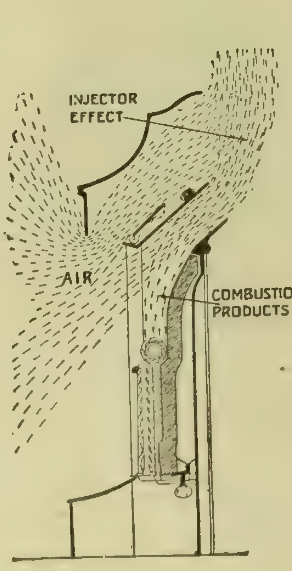
The small carton enclosing each mantle was to the outward eye a plain cardboard cylinder, with an outer covering of pink paper. The brand of the mantle was not proclaimed. The carton bore no print whatever. The clerk, being suspicious, soaked the carton in water. The pink paper peeled off, and in one case revealed the following:



The wording means "Gas-Mantle Factory, Diana Works." Another bore the title "Tiger Mantle," and underneath "Made in Germany."

The specimens were shown yesterday to the Office of Works by a representative of the "Daily Mail." An official replied that the Department had a perfect explanation of the incident; but it could not be communicated for publication.

WHAT "THE LANCET" (JAN. 15, 1916) SAYS OF WRIGHT'S "INJECTOR-VENTILATING" GAS-FIRES



"In the earlier days of the gas-fire the system fell into disrepute on three counts: first, the combustion products did not entirely escape up the flue, but vitiated the air of the room to some extent; secondly, even when that was not the case there was no efficient ventilation of the room as there is with the open coal fire; and thirdly, the flames were irritatingly noisy. Until quite recently we have not examined a gas-fire which quite satisfied us on all three points. Messrs. John Wright and Co., of Essex Works, Birmingham, have introduced an 'injector-ventilating' gas-fire which shows that these essentials have received considerable attention, and the result is a very important gain to this system of heating by radiant gas-fires. This fire not only secures the complete withdrawal of the products of combustion, but by means of a second opening a powerful in-draught of air from the room is induced to flow up the chimney. This ventilates the room as effectively as the open coal fire, and a true atmospheric flame is secured which is constant in its character and unaffected by variations of pressure; above all it is silent. It is surprising to see a clean blue intense flame free from purring sound. This has been effected by bringing about a thorough mixing of air and gas by means of a perforated thimble dropped into the opening of the burner. This is provided with vertical perforations, and in ordinary practice it cannot be choked with grit. The purring is probably due to a rapid series of minute explosions resulting from an imperfect mixture of gas and air. At the same time there is an ingenious fitting which provides for initial pressure adjustment. Altogether, this fire marks a most important advance, and is calculated to remove what prejudices remain against the use of gas for the purpose of domestic heating."

JOHN WRIGHT & CO., ESSEX WORKS, BIRMINGHAM.

DUBLIN ELECTRICITY UNDERTAKINGS.

Commenting upon what it describes as the "Dublin Electricity Muddle," the "Irish Independent" alludes to the eight counts in Mr. P. W. D'Alton's report, as expert investigator under a Special Committee of the Corporation. The counts are: Administration unduly complicated, charges for private supply unduly high, wages in respect of public lighting out of proportion to the gross revenue attributed to the service, high cost of secretarial department, system of coal supply as a monopoly, unreliable returns of units generated, use of obsolete engines, ineffective condensers. Mr. D'Alton's observations reveal, the "Independent" thinks, "woful and unreasonable mismanagement and incompetence;" and it holds that, had the undertaking at the inception been handled in a business-like way and conducted by men of normal commercial ability, many of the charges for which loans have been made could have been defrayed out of revenue.

With reference to a reply to Mr. D'Alton's report, by Mr. F. Allan (the Secretary of the Electricity Committee), expressing unbounded faith in the future of the undertaking, the "Independent" states that in 1911 he calculated on the retention of an additional 10 per cent. charge to consumers for four years more, and estimated a net profit of £20,000 for 1915, whereas the profit was only £748. "On the current year, the Committee estimated a deficit of £21,334; and in order to wipe this out, the charges for both power and light were increased, and, in addition, consumers have still to bear the 10 per cent." Complaint is made that "no fewer than five more or less independent departments have been set up in connection with the lighting of Dublin." As to Mr. Allan's contention that the Corporation had "a broad duty to the ratepayers generally, as well as a narrow one to that section of the ratepayers which uses electricity," the "Independent" charges that the Corporation "have mulcted both alike—first, by charging for electricity a higher price than is paid in any other large city in the United Kingdom, and, secondly, by making the ratepayers liable for deficits due to municipal blunders."

In a later comment, the "Independent" points out that the Dublin Tramways Company produce nearly 4 million more units than the Corporation; but the total coal bill of the Company for 1915 was only £20,596, as compared with an estimated cost of £39,605 for the municipal electricity undertaking. The gross income from lighting by the Corporation is only £105,440; while that of the Tramway Company is £333,899. "The surplus on the lighting, after payment of all charges, is negligible; so that the ratepayers, as such, receive no benefit from the undertaking. On the whole, it has been subsidized by the rates to the extent of over £46,000."

◆

East Cowes Gas Company.—The East Cowes Gas Company had an increased output of 22 per cent. (over 6 million cubic feet) for last year. The working is reported to have been excellent. The gas sold per ton of coal carbonized averaged 11,735 cubic feet.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Feb.* 14.

A certain amount of business continues to be done in pitch, but the market generally is quiet. The price remains unaltered at 19s. to 19s. 6d. per ton net, in bulk, at makers' works. There is an increased demand for tar for road work. In other products there is nothing of special interest to record.

The export price of sulphate of ammonia remains unchanged at £17 5s. per ton net, into buyers' bags, at makers' works, for 25 per cent. quality, and the position is firm. The home demand continues good.

Tar Products in the Provinces.

Feb. 14.

The prices for tar products remain about the same. There is nothing of importance to report concerning pitch. Creosote is quiet, with very little business doing. Solvent and heavy naphthas are still in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 3d. to 22s. 3d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. 1d. to 2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅝d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Feb.* 12.

During the past week there has been little disposition on the part of consumers and distributors in this country to make further purchases of this material, and, as new export trade is prohibited at present, with the exception of British possessions, values have declined still further. The closing quotations are £16 17s. 6d. per ton f.o.b. Hull, £17 f.o.b. Liverpool, and £17 5s. f.o.b. Leith. The market for future delivery is now only a narrow one, and no first-hand transactions have been reported; but it has transpired that sales have been made by dealers at a small premium on prompt prices for shipment from May to December.

Nitrate of Soda.

This market is firmer again, and holders on spot now require 16s. 9d. per cwt. for ordinary quality, and 17s. 6d. for refined.

Silence!

Silence is only one of the leading features of the new Carron Patent "STELLA" Gas Fire. Not partial, but absolute silence.

- **They won't light back.**
- **They emit a strong, brilliant, radiant heat, without any appearance of flame.**
- **They are free from troublesome regulators.**
- **They are absolutely hygienic.**

¶ *FOR FURTHER FEATURES OF THESE MODERN GAS HEATERS, WRITE FOR A COPY OF THE COMPANY'S "STELLA" GAS FIRE PAMPHLET: JUST ISSUED.*

No. 591 Carron Patent "Stella"
Silent Gas Fire.

CARRON COMPANY Works: CARRON, STIRLINGSHIRE,
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By Appointment
Ironfounders to
H.M. the King.

A complete assortment of CARRON manufactures on view at the Company's Showrooms:—

London—(City) 15, Upper Thames St., E.C.; (West End) 50, Berners St., W.; Liverpool—20-30, Redcross St.; Manchester—24, Brazennose St.; Bristol—6, Victoria St.; Birmingham—218, 220, 222, Corporation St.; Newcastle-on-Tyne—13, Prudhoe St.; Edinburgh—114, George St.; Glasgow—125, Buchanan St.; Dublin—44, Grafton St.

Established
in the Reign
of George II.

Sulphate of Ammonia.

From another source, it is stated that there has been practically no difference in the prices throughout the past week. Outside London, makes are quoted at £16 12s. 6d.; Hull, £17 5s.; Liverpool, £17 7s. 6d.; Leith, £17 7s. 6d. to £17 10s.; Middlesbrough, £17 7s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is active; but large quantities of coal are being taken up by the Admiralty, and this restricts in some measure the general shipments and the forward business. In the steam coal trade, the pressure of the special demand seems to be most felt, and prices are high but nominal. Best Northumbrian steams are as much as 32s. 6d. per ton f.o.b.; second-class steams are about 27s. 6d. to 29s. per ton, and are very firm; and for steam smalls, the quotations vary from 14s. to 17s., according to the class. Production is fairly good when the limited number of miners is called to mind. In the gas coal trade, the long contracts take up a large part of the output, and the amount left finds ready sale, with stiff prices. Best Durham gas coals are very firm at 25s. to 25s. 6d. per ton f.o.b.; second-class gas coals are about 24s. 6d. per ton; and "Wear Specials" are from 26s. per ton f.o.b. There is a strong demand for other classes of Durham coals; so that gas coals are in some measure affected, and they are kept scarce. The rate of freights is a little easier, owing to the fewness of the loading turns available; but gas coal from the Tyne to London has still to bear a freight of about 14s. 6d., unless there are contracts to prevent the current freight applying. There are few contracts now in treaty—high prices and freights rendering buyers cautious. In the coke market, the demand for coke for shipment is full, and prices are well maintained. Gas coke, however, seems fairly plentiful, and good makes are from 26s. to 27s. 6d. per ton f.o.b. in the Tyne.

Cleveland Water Company.—At the 95th half-yearly meeting of the Company, which was held at Saltburn last Wednesday, Colonel W. H. A. Wharton, who presided, referred to the loss the Company had sustained by the death of Mr. W. I'Anson, who had acted as Engineer and Secretary since the inception of the Company 46 years ago, and under whose supervision the whole of the works were constructed. The financial statement showed a balance of £5033 on the working; and the Directors recommended that £3400 should be used in the payment of dividends of 10 per cent. per annum on the "A" shares and 7 per cent. on the "B" shares, and that £1633 should be carried forward. It was reported that Mr. W. M. I'Anson (son of the late Engineer), who had acted as Assistant for 22 years, had been appointed to the position of Engineer, and that Mr. W. J. Deighton, who has been in the Company's service for 40 years, had been made Secretary. The action of the Directors was approved.

Walker and Wallsend Union Gas Company.

The annual meeting of the Company was presided over by the Chairman (Mr. C. J. Potter), who stated that the gas sales showed an increase of 1·11 per cent. over the previous year, and were the highest that had been obtained in any one year. In the second half of the year, however, there was a falling off, due entirely to the lighting restrictions. The balance on the revenue account was £12,579, which was within a few pounds of the previous year. The Directors were recommending the full statutory dividends, and a further £500 to the insurance fund, which left a balance of surplus profits of £1105 to be carried to net revenue. All local gas undertakings, and nearly all in the kingdom, had had during the past year to raise the price of gas. In deciding to increase the charge 2d. per 1000 cubic feet, the Directors were influenced by the evident increased prices of coals, materials, and other extra charges during the present year. Under the Company's Act and the operation of the sliding-scale, the dividends on the ordinary stocks would be reduced 5s. per cent.; but he trusted this would not be of long duration. The report was adopted.

Hindley Gas-Workers' Wages Advanced.—At the last meeting of the Hindley (Lancs.) District Council, it was reported by Mr. H. O. Timmins (the Gas Manager) that an application had been received through the Gas-Workers' Union for an increase of stokers' wages from 5s. 6d. to 6s. per day. The Council decided to grant the advance asked for as from the 3rd ult. It was further agreed that labourers in the department should be paid at the rate of 6d. per hour.

Middlesbrough Coke-Oven Gas Supply.—The Middlesbrough Gas Committee have had under consideration a letter from the Ministry of Munitions, asking the Corporation to accept a modification of Messrs. Samuelson and Co.'s contract for the supply of gas, involving the extraction from it by them of the greater part of the benzol, of which, it is calculated that 14,000 gallons is contained in a month's supply. The firm reported that it would be at least two months before the stills were ready to debenzolize the gas. The matter was left with the Chairman, the Town Clerk, and the Gas Manager (Mr. David Terrace), with plenary powers.

Sleaford Gas Company.—It was announced by the Directors in their report on the past year's working that, owing to the very large increase in the cost of coal, the price of gas had had to be raised from 2s. 10d. to 3s. per 1000 cubic feet. It was added that the sum of £406 had been expended in the erection of plant for the recovery of toluol, at the request of the Government; and this had been charged to revenue account. There had been a diminution in the consumption of gas, due to the lighting regulations made by the military authorities. At Dec. 31, there were 1463 meters in use (824 prepayment, and 639 ordinary). The report, which was submitted to the shareholders last Thursday, recommended a dividend at the rate of 10 per cent. per annum, free of income-tax.

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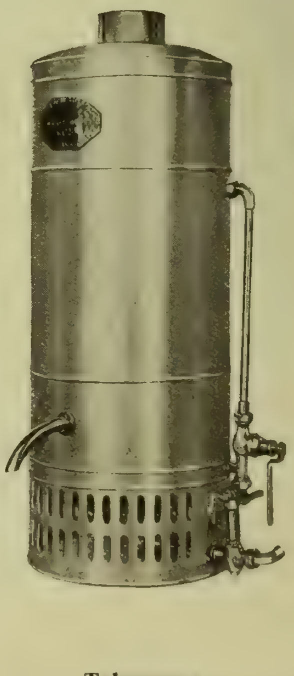

Coke for Bath-Boilers.

Having regard to the price of coal, says the "Municipal Journal," the Baths and Washhouses Committee of the Deptford Borough Council recently authorized an experiment to be made for using coke with the coal in the furnaces of the boilers at Laurie Grove baths; but it was found impracticable. The Gas Company then offered to instal free of charge in one of the boilers a steam-jet apparatus, with a view to coke being used exclusively as fuel, for a period of four weeks, on the understanding that if the test results in effecting the economy claimed for it the Council will purchase the apparatus at a cost of £12 12s. The Company agree to remove the apparatus free of charge to the Council, if it is proved unsatisfactory at the end of the trial. It is estimated that the provision of the apparatus will save £5 10s. 6d. in the cost of the baths fuel consumption per week. The apparatus has been fitted to steam-boilers at several London factories; and favourable reports have been received as to the results at these places. The Committee have given directions for the apparatus to be fixed in accordance with the above arrangement.

Price of Gas at Tandragee.—The Tandragee (co. Armagh) Urban Council have rejected a proposal to discontinue giving 5 per cent. discount to gas consumers whose yearly accounts amount to £5 and upwards. They have, however, decided to consider the advisability of increasing the price of gas after the close of the financial year.

Dorchester Gas Company.—The Directors submitted a report at the half-yearly meeting of the Company last Tuesday, in which they stated that there had been a decrease in the consumption of gas, as compared with the corresponding period; the chief causes being the complete absence of cold weather and the restricted lighting of both public and private lamps. The Board regretted having to recommend (in view of the increased cost of all materials required, including coals and labour, and the heavy cost of renewals at the works) that a dividend of 6 per cent. be declared on the ordinary and 6 per cent. on the preference shares, both less income-tax.

Melton Mowbray Gas Company.—Owing to the great advance in price of coal, and the reduction in consumption of gas during the past six months, the Directors are not able to distribute their usual interim dividend, but are paying 2s. per share less—income-tax paid as usual. There is now no public lighting, and the prospect of keeping up the consumption of gas seems very doubtful. A motor lorry for the carting of coal and delivery of coke has been purchased, and is giving every satisfaction. During the past six months, a new boiler has been fixed; and this has been charged to the revenue account. The Company have also during the half year been to the Board of Trade for new powers, which it is hoped may in time to come prove beneficial to the undertaking. The price of gas has been slightly increased. Though coke has realized much more than usual, tar and liquor have not furnished such good results.

Signalling the Approach of Hostile Aircraft.

As an instance of the arrangements which are being made over the country, it may be stated that intimation was last week made by the Head Constable of Liverpool that the authorities had now come to practically the same arrangements with the Liverpool Gas Company as they had done with the Electric Supply Department as to the course to be taken in case of an air raid in the vicinity. The warning to the public will consist of gradual diminution; and this will be commenced as soon as the signal agreed upon has been passed to the gas authorities. The reduction will be immediately observed; and this will affect all gas-lights in use, whether in private houses or in the streets. The lighting will gradually go on diminishing, until it arrives at about a quarter of what it would be at full pressure. The diminution will be quite patent to private consumers of gas, and to persons in the streets or elsewhere, and will be effective in about ten or twelve minutes. It will be taken as a warning that official intimation has been received of the presence of hostile aircraft somewhere. When the gas is lowered, consumers will see to the cocks or taps being properly turned off; and they are advised to turn the gas off at the meter. Care must be taken to see that when the gas comes on again, it does not find the taps open, and so be a possible source of danger.

Coatbridge Gas Company.—At the recent annual meeting of the Company, dividends under the sliding-scale on the various classes of shares were declared; and at a subsequent extraordinary meeting, authority was given by the shareholders to the Board to raise additional capital to meet proposed expenditure on the introduction of modern carbonizing plant.

Labour Unrest in South Wales.—A South Wales correspondent writes that the dispute which has arisen among the gas-workers in some of the coal districts of South Wales, with reference to the question of wages, has spread to the Merthyr Gas-Works, where, he understands, that notices were last week-end tendered to terminate contracts. The gas-workers' official representative interviewed the Company's Manager (Mr. J. E. Kenshole); and, as a result, the men are stated to have been offered rather better terms than some of those accepted in other places. It was reported, however, that the terms had been rejected.

Edinburgh Corporation and Automatic Gas Lighting.—A Sub-Committee of the Edinburgh Town Council last Tuesday visited Messrs. Alder and Mackay's works, with a view to seeing in operation the firm's pressure-wave automatic system of lighting and extinguishing gas-lamps, as applicable to the public lamps of the city. It is understood the members of the Sub-Committee were favourably impressed with what they saw, and with the possibilities of the system, and agreed to recommend the full Committee to agree to an experimental installation of the system being fitted up as quickly as arrangements can be made in two districts of the city. The Lord Provost (Sir Robert K. Inches) accompanied the deputation. Gorgie will probably be one of the districts.

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Cheaper Gas at Barnoldswick.—As a result of the excellent working of the new plant at the Barnoldswick Gas-Works, the Gas Committee have decided to grant an additional discount of 3d. per 1000 cubic feet on all gas accounts for the present and ensuing quarter, thus reducing the net price for ordinary consumers from 2s. 9d. to 2s. 6d., and for power purposes from 2s. 7d. to 2s. 4d. per 1000 cubic feet. The present price of 13s. 4d. per ton for coke at the gas-works is considerably below that of neighbouring authorities. This, however, is only to local ratepayers; outsiders being charged at the rate of 16s. per ton. Last year the profits from the gas undertaking relieved the rates to the extent of 4d. in the pound. The Council and the Manager (Mr. J. W. Thompson) must be gratified at the position of affairs.

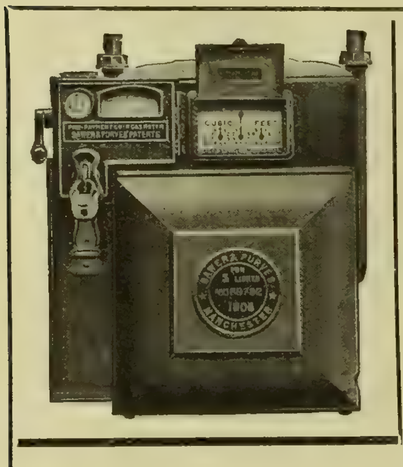
Malton Gas Company.—The Malton (Yorks.) Gas Company's half-yearly report states that the trading has been most unfavourably affected by the war. The general result is that the profit has fallen considerably below the average, notwithstanding the increased price of gas. The amount available for division is £2878 (including £824 balance of revenue account, and £1909 brought forward); and the Directors recommend the payment of a dividend of 5 per cent. for the half year, free of income-tax. Thus will £1200 be absorbed; and, deducting the mortgage and other interest, there will be £1596 to carry forward. The dividend is a reduction of 1 per cent. upon former figures for the half year. At the meeting, Mr. W. H. Pearson, who presided, said that for the first time for a great number of years they had been unable to earn the amount necessary for the payment of dividends. Hitherto they had paid 6 per cent. for the half year, which absorbed £1440. Last half year they only earned £887, and the Directors recommended a reduced dividend of 5 per cent. This was approved.

Whitby Gas Company.—In their report for the year ended Dec. 31 last, the Directors state that the profit and loss (or net revenue account), after charging it with interest on debenture stock, interest on deposits, and bank interest, and after providing for the interim dividend, shows a balance of £1158, out of which the Directors recommend the payment of dividends at the rate of 3 per cent., less income-tax, on the original capital, and of £2 2s. per cent., less income-tax, on the additional and new additional capital for the past half year, making, with the interim dividends, 6 per cent. on the original capital, and £4 4s. per cent. on the additional and new additional capital for the year. This will absorb £918, and leave a balance of £240 to carry forward. The Directors regret to state that the sale of gas decreased by 14 per cent. compared with the previous twelve months. This is entirely due to the abnormal conditions prevailing, and, taking into consideration the lighting restrictions, and the absence of visitors during the season, is less than might have been expected. During the year the Company have, at the request of the Ministry of Munitions, been extracting certain constituents from the gas required to increase the supply of high explosives. This process, while of no financial gain to the Company, is of vital necessity to the cause of the Allies. Several of the Company's employees are serving with His Majesty's Forces, and allowances amounting to £104 have been paid to their dependants.

Bradford Gas Poisoning Case.—An inquest was held last week, at Bradford, on the body of Harold Rowan, the child of a soldier on service, who died from gas poisoning [reported in the "JOURNAL" last week, p. 328], and upon Peter Lester, a child in the next house who was ill, but whose death was regarded as being due to the escape of gas. Mrs. Rowan and her other children had recovered from the effects of the gas sufficiently to give evidence. Other evidence was that the smell of gas had been noticed around the house for a week or two; but it had apparently not been reported to the authorities. Mr. Charles Roper, the Distributing Superintendent to the Bradford Corporation Gas Committee, said the first report from the street was received about 6 o'clock on Friday morning—the morning of the discovery of the affected people; and he was personally present later when the main in Crown Street was uncovered. There was a crack in the pipe not extending entirely round it. The pipe was laid before 1885, though he could not say how long before. The life of a gas-pipe was very long, and might be sixty years. The pipe was about 2 ft. 6 in. from the surface, and 4 or 5 feet from the houses. When there was was an escape it was possible for it to percolate through the soil. There were no trams or telegraph poles in the street which might have interfered with the pipe. Dr. Shackleton said that death in both cases was due to asphyxia caused by coal gas. The Coroner, in summing up, said it might have been the case that there has been a certain amount of flaw in the pipe; and the "bang" which occurred might have been caused when the pipe gave through the pressure becoming too strong for it. The Jury could take it there had been no negligence. The first report to the authorities seemed to have been at 6 o'clock in the morning, and the pipe was being repaired shortly afterwards. He did not see that any criminal responsibility could be put upon any person or persons whatever. The Jury returned a verdict of "Accidental death" in each case.

The Darlington Corporation General Purposes Committee decided last Thursday to recommend that in regard to gas-works employees the war bonus scale should be amended to provide an increased payment of 1s. per week to each employee. This will mean an additional expenditure of £343 per annum.

In response to a resolution of the Bradford City Council calling for more light, the Chief Constable has replied that, in accordance with the powers vested in him under the Home Office Lighting Order, he had authorized the lighting of public lamps at the junction of streets and roads and other places. He had prohibited the lighting of private lamps, and of public lamps in the side streets. The whole matter of lighting had been taken into review, and special claims to lighting where there were steps or posts had been acceded to. Public lighting had been increased by 55 per cent., and this was the utmost he could do, having regard to the order that public safety be provided for. Since the new order was put into force, accidents after sunset had decreased by 45 per cent., as compared with the same period under the order as it was previously.



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APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Feb. 9.]

Nos. 1437—1769.

Bellamy, A. R.—"Suction-gas generators." No. 1576.
Bradshaw, G. D.—"Gas-burners." No. 1659.
Cole, H. E. C.—"Automatic gas-saving control." No. 1670.
Dempster and Sons, R.—"Feeding-shoots for delivering coal, &c., to conveyors." No. 1624.
Humphrey, H. A.—"Valves." No. 1465.
James, C.—See Bellamy. No. 1576.
Morris, J. M.—"Gas-generators." No. 1604.
Rusdell, W. J.—See Humphrey. No. 1465.
Smith, G.—"Compound suitable for heating or gas-producing purposes." No. 1732.
Southgate, A. W.—"Gas-regulators." No. 1736.
Toogood, H. J.—See Dempster and Sons, R. No. 1624.
Tredegars Limited.—See Morris. No. 1604.

A fire in the store-rooms at the Lower Gornal Works of Messrs. Gibbons Bros. last Wednesday resulted in the partial destruction of this part of the building, and considerable damage to the stock. The fire brigade were successful in confining the conflagration to the one portion of the premises.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

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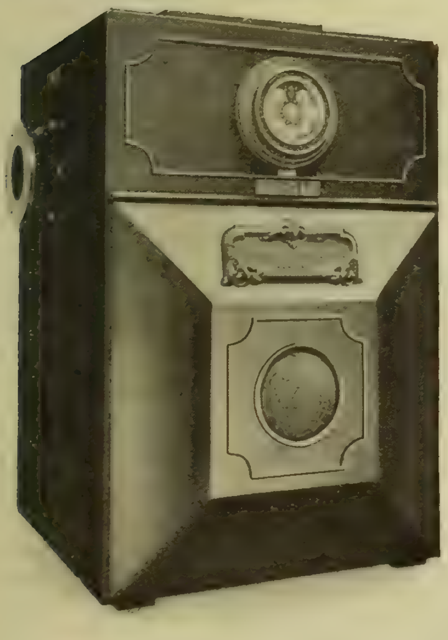

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The Chairmen and Vice-Chairmen of the various Committees of the Rotherham Town Council have been requested to take into consideration the question of horse-hire, and to report as to the advisability of making arrangements by which the carting work of the Corporation might be done by means of motor traction. The proposal is through the demands of the carting contractors. The Gas Committee are of opinion that, with light motor lorries carrying up to 2 tons, the work would be done more cheaply than by horse haulage.

STOCK MARKET REPORT.

The Stock Exchange has had a better week. One gratifying feature was the substantial increase in business; and if regard be had to the amount of money going into Treasury Bills and Exchequer Bonds—a fair portion of which would in all probability have come into Capel Court—this means a good deal. Then a tone of cheerfulness characterized markets in general with but few exceptions; and some of them displayed quite remarkable strength. The gilt-edged division were firm as a rule, though the War Loan was not at its best at the close. Choice Colonial issues were in steady demand. Home Rails ought to have been enlivened by the good dividend announcements of two important lines, but somehow or other they failed to respond. Americans were better to a moderate degree; but Canadians emancipated themselves from the thrall, and made a fine advance. The Foreign Market generally was firm; the French loan, and especially Japanese, being most conspicuous in the upward movement. *Per contra*, German 3 per cents were sold down to a 6½ per cent. price for money. Argentines were irregular, advances being followed by realizations; while South Africans were much the same. The greatest animation was displayed in the Miscellaneous group, where rubber, oil, and metals had quite a fine time. Among topics of interest was the announcement of a French Government scheme to open the Stock Exchange for the negotiation of stocks belonging to French owners through the Bank of France and the Bank of England. Inside the House further action is being taken to press for the removal of the minimum prices which still remain operative. The Committee will probably be desired to consider further the question of more Saturday holidays. Business in the Gas Market was quieter still, hardly anything being touched except Gas Light and Coke. The tendency was firm, to which the proceedings at the meetings of some important companies, and the accounts issued by others, contributed. The Money Market was harder.

Bargains done for cash during the week were as follows: On Monday, Bombay 5 1/16, Commercial debenture 57, Gas Light ordinary 78, 78½, South Metropolitan 77½, ditto debenture 60½. On Tuesday, Bombay 4⅞, Gas Light ordinary 77½, 78, 78¼, 78⅜, 78½, ditto preference 76¼, Imperial Continental debenture 66½, 67, South Metropolitan 77, 77½, 78, ditto debenture 60¾, 61. On Wednesday, Commercial debenture 57, Gas Light ordinary 77¼, 77½, 78, 78½, ditto maximum 61, Monte Video 8⅜. On Thursday, Bombay 5, Commercial debenture 56¾, 57, Gas Light ordinary 75¾, 76¼, 77½, 77¾, ditto preference 74, Newcastle 80. On Friday, Commercial 3½ per cent. 73⅞, 74⅛, Gas Light ordinary 75⅜, 75½, 75¾, 76, 78, ditto maximum 60¾, 61, ditto debenture 60⅞, 61, 61¼. On Saturday, Gas Light ordinary 76.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

* * *

At an inquest at Middlesbrough recently, on an elderly man who had "gassed" himself by throwing a coat over his head and placing a gas-ring near his face, the Coroner asked the doctor how long it would take a man to suffocate under such circumstances. The reply was that, with the coat over his head, deceased would be insensible in about three minutes. "Asphyxiation" was the verdict.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5¼	Alliance & Dublin Ord.	59—64	8 18 2	..
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 8	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	4⅞—5 1/16
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
373,480	10	,,	7	7/-	B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Deb.	..	—	..
992,015	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 8	..
731,920	,,	,,	†11	55/-	Do. New	204—209	5 5 8	..
55,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 8 4	..
244,200	,,	,,	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	,,	,,	5⅛	46/8	Do. 3½ p.c. do.	103—105	5 1 6	73⅞—74⅛
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	56¾—57
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 8	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	..
16,327,185	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	75⅜—78½
2,600,000	,,	,,	3½	3½	3½ p.c. max.	76—79	4 8 7	60¾—61
4,062,235	,,	,,	4	4	4 p.c. Con. Pref.	96—99	4 0 10	74—76¼
4,674,850	,,	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	60⅞—61¼
130,000	,,	,,	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	6	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7¾	7¾	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅛	6¼	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	..
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	66½—67
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	,,	,,	7		B	146—148	4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	8	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	6	6/-	Monte Video, Ltd.	11½—12	6 13 4	8⅜
1,875,892	Stk.	July 29	4½	4¼	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	80
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 13 4	..
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4¾—5	5 0 0	..
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 8	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	77—78
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60½—61
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	135—138	5 8 8	..
782,275	,,	,,	6	6	B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 8	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅞	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Works Engineer and Manager. Cannock, &c., Gas Company. Applications by Feb. 28.

Works Superintendent. South Shields Gas Company.

Sulphate Maker. No. 6155.

Appointments Wanted.

Representative. No. 6152.

Plant, &c. (Second Hand), for Sale.

Gas-Meters. Royal Mint.

Scrubber. No. 6151.

Meetings.

Brighton and Hove Gas Company. No. 5, Great Winchester Street, E.C. March 3. Two o'clock.

Harrow and Stanmore Gas Company. Westminster Palace Hotel. March 6. 12.30 o'clock.

North Middlesex Gas Company. No. 5, Great Winchester Street, E.C. Feb. 28. 2.30 o'clock.

Riddings Gas Company. No. 139, Cannon Street, E.C. Feb. 29. Twelve o'clock.

Southgate Gas Company. No. 5, Great Winchester Street, E.C. March 2. 3.45 o'clock.

TENDERS FOR

Coal.

Limerick Gas Department. Tenders by Feb. 21.

Tar and Liquor.

Haworth Urban District Council. Tenders by Feb. 26.

JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST. LONDON.

VOL. CXXXIII., No. 2754.] TUESDAY, FEBRUARY 22, 1916. [68TH YEAR.

EDITORIAL NOTES.

Comparative Results—War and Pre-War.

IN times of peace, comparative working and financial analyses in respect of periods or different undertakings are interesting and instructive, as showing the relative progress that is being made in both the manufacturing and commercial quarters, provided that, where the results apply to various concerns, those who examine the comparisons are competent, from technical knowledge and possession of information as to the individual conditions of the undertakings, to make due allowances for differences. In an unexampled time such as the present, similar comparative working and financial analyses are mainly of interest in presenting the measure of adverse effect that the prevailing conditions have had upon concerns, under their individual circumstances. This will be borne in mind when considering the analysis (by Mr. F. J. Bradfield, the Secretary of the Commercial Gas Company), which it is our pleasure to publish to-day, of the past half-year's accounts of the three Metropolitan Gas Companies and of the four principal Suburban Gas Companies. We congratulate the compiler upon the promptitude with which he has accomplished this useful piece of work, and submitted the results to our readers. Following custom, he has confined the comparisons of the past half year with those of the second half of the preceding year, so that we have two war half years contrasted; and therefore the differences as shown only illustrate the partial effect of the war upon the financial workings of the Companies, instead of the full effect which comparison with the second half of 1913 would have given. But, of course, there must be some limitation even to statistical exercises of this character; and readers can ascertain for themselves what those full effects have been by turning back to the corresponding work performed by Mr. Bradfield for the second half of 1913, and making the comparative calculations for themselves.

For example of the substantial differences made by the war, by skipping the December half of 1914 and going back to the second half of 1913, the figures as to the cost of coal and oil, less residuals, may be taken. For the past half year, the Commercial and the Wandsworth Companies are the only two of the seven that, compared with the December half of 1914, show an actual reduction per 1000 cubic feet of gas sold on the net cost of coal and oil. The net cost in the case of the Commercial Company was 7·37d., or a decrease of 0·60d.; but the figure for the 1914 half compared with the 1913 half presented an increase of 1·43d. The net cost of coal and oil per 1000 cubic feet sold last half year in the case of the Wandsworth Company was the lowest of any—viz., 6·8d., or a decrease of 1·12d.; but the 1914 half showed the small increase of 0·46d. This result must be almost unique. In the case of all the other Companies, there were substantial increases in the half year to be added to advances in the 1914 half, before ascertaining the full effect of the war conditions on the net cost of manufacturing materials, as compared with the corresponding half year immediately preceding the war. The net cost of materials last half year to the Gas Light and Coke Company was 8·60d. per 1000 cubic feet of gas sold—an increase of 0·92d. upon the second half of 1914, which half year exhibited an increase of 2·65d. upon the corresponding period of 1913. The figures for the South Metropolitan Company were: Net cost of coal last half year, 9·62d.—an increase of 3·33d. upon the increase of 1·33d. in the second half of 1914. The net cost for the Brentford Company was 10·81d.—the increase being 1·67d. upon the increase of 1·21d. in the second half of 1914. The South Suburban Company's net cost was 10·96d., or an increase of 2·2d., upon an increase of 0·70d. in the corresponding half of 1914. The Tottenham Company's net cost was 11·66d., or an increase of 2·19d., with 1·56d. advance in the December half of 1914.

If further the total expenditure (less residual products) is taken to ascertain the difference between last half year and the corresponding half preceding the war, we see better still how war conditions have told. In the case of the Commercial Company, the total expenditure (less residuals) per 1000 cubic feet of gas sold was 0·09d. less last half year; but in the second half of 1914, there was an increase of 2·42d. In the December half years of 1915 and 1914, the increases of the Gas Light and Coke Company were respectively 2·04d. and 2·4d.; of the South Metropolitan Company, 4·65d. and 0·37d.; of the Wandsworth Company, 1·44d. and 0·18d.; of the South Suburban Company, 5·57d. and 0·77d.; and of the Tottenham Company, 3·25d. and 0·46d. In the case of the Brentford Company, the increase last year was 0·35d.; but there was apparently no measurable movement one way or the other in the December half of 1914 compared with that of 1913.

Dividends are unfortunately now smaller owing to the higher price of gas; but consequent on the reduction in consumption during the December half of 1914, and the comparatively small increases then made in price, the amount paid for dividend and interest per 1000 cubic feet of gas sold showed increases in all the Companies save one, compared with the second half of 1913. The additions were: Gas Light and Coke Company, 0·28d.; South Metropolitan Gas Company, 1·41d.; Commercial Company, 0·43d.; Brentford Company, 0·08d.; Wandsworth Company, 0·49d.; Tottenham Company, 0·76d. The South Suburban Company were the exception, with a reduction of 0·23d. But last half year, due generally and principally to the higher prices of gas and further reductions of dividends, there were decreases in all cases but one, compared with the second half of 1914, in the requirement for interest and dividend per 1000 cubic feet of gas sold. The exception was Brentford, which increased by the infinitesimal amount of 0·04d. Decreases in the other cases were: Gas Light and Coke, 0·97d.; South Metropolitan Company, 0·47d.; Commercial Company, 0·90d.; Wandsworth Company, 0·25d.; South Suburban Company, 0·88d.; Tottenham Company, 0·67d.

The figures presented here illustrate, especially those referring to net costs, that the tables published this week must only be taken as making contrast between two war half years, and not as indicating the full weight of the effects of the war. This, of course, is obvious to any professional gas man. But the "JOURNAL" is, in relation to financial and commercial matters, perused by many others than professionals; and it is therefore advisable to make the point. However, the figures quoted also instance the interest that there is to be gained by exploring half year by half year Mr. Bradfield's tables of statistics, the value of which was very properly acknowledged both by the Chairman (Mr. W. G. Bradshaw) and by Mr. H. E. Jones, at the meeting of the Commercial Gas Company last Thursday.

New Coal Contracts and the Price Limitation Act.

THERE was one especially good piece of intelligence in the speech of the Chairman of the Commercial Gas Company (Mr. W. G. Bradshaw), at the meeting of the proprietors last Thursday, which will have general interest and approval, and be looked upon as of good augury. Although the Company have contracts for coal which have still some months to run, the Board have already arranged for their usual supplies for more than twelve months ahead; and—this is the point of interest—while the prices have not been fixed in all cases, the Directors have actually contracted for a substantial quantity at a price "considerably less" than the limit fixed by the Price of Coal (Limitation) Act, 1915. This is an exceedingly satisfactory announcement, and particularly so the words "considerably less."

The fact that this contract has been entered into by colliery owners of good position testifies various things. It is clear, for instance, that little reliance can be placed upon some of the reports emanating from interested parties as to the impossibility of coal now being raised and sold at prices governed by the Price of Coal (Limitation) Act, and that recourse must be had to the provision of the Act which gives a right of appeal to the Board of Trade from the standard amount of 4s. It is apparent from the statement of Mr. Bradshaw that the colliery owners concerned in the making of this contract see no need for any appeal to the Board of Trade; on the contrary, they find themselves in a position to do some substantial prospective business at a price "considerably less" than that allowed by the Act. The announcement also indicates that there are colliery owners who do not regard the price allowed under the Act as at once a minimum and a maximum, and who are prepared to bargain for contracts on lines below the maximum. But the Commercial Company are evidently fortunate in the colliery owners with whom for years they have done business. They are reasonable; and Mr. Bradshaw frankly and fully acknowledged that they had treated the Company very well, not only before the war, but during the disturbed conditions created by it. "Our ships have been loaded "promptly, and our supplies have been well maintained." Not all the London and Suburban companies could pay a similar tribute to the whole of the colliery owners with whom they have contracts running.

However, the Commercial Gas Company are to be congratulated upon the position in which they find themselves in respect of coal contracts well ahead. That is only part of the good fortune which is attending the Company in these times when good fortune requires to be closely searched for before being discovered. With an increase of only 4d. in the price of gas, the Company have done extremely well financially; and this is largely attributable to the possession of their own colliers, which, as the figures given in Mr. Bradshaw's speech disclose, are being run to-day, despite all the additional expenses, at 10s. per ton below current market rates of freight. Another feature of the proceedings was the statement that the Company are now contemplating, under the changed circumstances of the times, extending their operations into tar distillation; and still a further one was the handsome and well-deserved compliment paid to the late Assistant Engineer of the Company (Mr. G. M. Gill) upon his selection for the distinguished position of Chief Engineer of the South Metropolitan Gas Company.

Pitch and Coal Charges.

What Mr. Thomas Glover described, in the columns of the "Journal" for Feb. 1, as the "Burden of Pitch" is a condition that is growing apace with the comparatively small outlet that the substance has, owing to the war and the enormous rates of freight. We cannot go on annually producing in the gas industry 750,000 tons, and the coke-oven industry a very considerable amount—an amount also running into hundreds of thousands of tons—with outlets almost completely closed against it, without, through the accumulations which are seriously embarrassing the tar distillers, affecting the economic position of the commodity far ahead. When the outlets are again opened, we shall still be producing on the old scale, with the great mass of accumulated stock of which to dispose. There can be only one result of this condition, unless relief can in the meantime be obtained, and that is a very long period of low values. This is being generally recognized; but the direction in which to secure relief is the question of the hour. Briquette making does not "take on" to any large extent in this country; and it is not a means of relief that can in these times be readily applied. The use of pitch for road-making has the drawback that little money is at present being spent in this direction. The most promising outlet therefore for restricting the accumulations of pitch is its use admixed with coal for gas making. If pitch to the extent of 5 per cent. of the weight of coal carbonized could be universally used, there need be no accumulation beyond that already in store up and down the country. This is a condition that is not likely to be achieved. It is, however, one of the necessities of the times that the matter shall not be lightly discarded as being a promising measure of relief, but that there should be widespread trial of it. Trials are being extensively made by the London Companies, and at gas-works in the district of the Manchester Institution of Gas Engineers; but few definite results have yet been published. Mr. Thomas Glover, as mentioned above, gave his in our issue of Feb. 1; Mr. Alex. Yuill in our "Correspondence" columns to-day details the results obtained and experiences he has had at Dundee. We emphasize his suggestion that other engineers who have made trial should publish their results.

But while some gas engineers do not find any particular benefit from utilizing pitch in the manner suggested, both Mr. Glover and Mr. Yuill are satisfied that using 5 per cent. of pitch properly (not indiscriminately) mixed with coal is a practicable and to an extent a profitable matter. But when the data presented by both experimenters are studied—those from Mr. Yuill approximately confirming those of Mr. Glover, though the pitch was without question derived from very different coals—the profitableness does not appear to be of a direct or substantial nature. The great indirect advantage appears to lie in preventing the pitch market being laid in ruins for a considerable period. Both Mr. Glover and Mr. Yuill prefer to limit the proportion of pitch to coal to 5 per cent., but for different reasons. When working up to 10 per cent. at Norwich, trouble commenced in the tops of the ascensions and through thickening of the tar in the hydraulics; while at Dundee difficulty was found through the clogging of the pusher-heads of the hydraulic machinery. However, in regard to the general results, the article by Mr. Glover as published on Feb. 1 and Mr. Yuill's letter printed to-day should be read in conjunction; and, taking the experiences together, it will be agreed that, as a measure of relief, the use of 5 per cent. of pitch could, without detriment to the main results, go on indefinitely, where the gas undertakings do their own tar distilling, or where gas-works have outside tar distillers in reasonably close proximity. The matter is worth very full consideration; for the war has made the question of pitch disposal a very large one for the gas industry.

High Efficiency from Oxide Purification.

The paper Mr. William Bennett read before the members of the Western District of the Scottish Junior Gas Association last Saturday deserves a better title than "Notes on Purification." It is constituted of the results of a detailed study of the subject at Greenock; and we can see at the back of it, the encouragement and guidance of Mr. James Macleod, F.I.C. There is one thing that is clear from this many-pointed contribution, and it is that we have not, with all the work that has been done in connection with purification, and all the publication that has been made of the issues of investigation, come to the end of the scientific interest and of the solution of all the problems that are to be found within the works' series of oxide purifier-boxes.

In part, the paper presents afresh principles that should be adopted in securing the best possible results from oxide; and that Greenock is in a position to give advice on this subject will be conceded when it is pointed out that the sulphur content of the gas supplied to the town averages 7·5 grains per 100 cubic feet. With such an efficiency as this, there is no need at Greenock to give attention to any heat or other system outside oxide purification to increase the sulphur purity of the gas. The very attempt to further remove the carbon bisulphide and sulphur compounds other than sulphuretted hydrogen would be a work of supererogation, a complication, and quite unnecessary expense. But circumstances alter cases. However, the forward rotation system is practised at Greenock, the oxide purification capacity is on liberal lines, and vertical retorts are in use; and with vertical retorts in use there is advantage from the outset in the matter of purity. The whole purification system, apart from oxide, must be worked to a high state of chemical efficiency. The low sulphur result named, Mr. Bennett says, led to the idea that some reduction of the sulphur compounds other than sulphuretted hydrogen took place in the purifiers—possibly through the absorption of carbon bisulphide by the large amount of free sulphur in the oxide. But an even lower result was achieved when, to put the theory to proof, gas was led from the inlet of the purifiers through two small purifiers containing entirely new oxide, and thus freed from sulphuretted hydrogen. The result of a test showed 9·06 grains of sulphur at the inlet of the purifiers, and 5·7 grains at the outlet of the purifiers proper. This is the result of one test only; and we hope that Mr. Bennett will pursue the matter, and try to arrive at indisputable reasons for the extraordinary purification results that the figures disclose. This result and others that have been published show that there is a good scope for still further investigation into causes and effects in connection with purification. We remember that, in his

Presidential Address to the Manchester Institution in 1914, Mr. J. G. Newbigging pointed to the curious sulphur results that he obtained with two coals; the coal with the lower sulphur content giving the larger number of grains of carbon bisulphide in the purified gas. The actual figures were: No. 1 contained 1·55 per cent. of sulphur, and gave 33·78 grains of carbon bisulphide in the purified gas; while No. 2 contained 3·02 per cent. of sulphur, and gave 23·41 grains of carbon bisulphide in the purified gas. The conclusion Mr. Newbigging drew from these paradoxical results was that the condition in which the sulphur exists in the original coal is a determining factor in influencing sulphur in the purified gas, and not its total content.

It is evident that there are other things besides a strict compliance with rules and methods, and controllable physical conditions within the purifiers, that have effect on purification results, and which go a very long way in the matter of realizing efficiency. We want to know more about these matters; and this will only be achieved by persistent progressive research. It is hoped Mr. Bennett will continue his work in this connection. The reference, too, that he makes to vertical retorts—as to temperature governing the amount of impurities, and as to the differences in the impurities when working with good top heats and when working with a fairly uniform heat through the retort—gives hope of forthcoming additional interest being supplied in this particular direction.

The points of interest in the paper are so many that useful comment cannot be directed to them all. Those who read the contribution will probably find things with which in practice they disagree, and may also be reminded of incidental points which perhaps have escaped their memory. For instance, the effect upon efficiency of ammonia pressure in liquors of various strengths and of ammonia pressure in gas is not always borne in mind. As Mr. Bennett puts it, if the ammonia pressure in the liquor is greater than the ammonia pressure in the gas, then ammonia will be given up to the gas; whereas, if the ammonia pressure in the gas is greater than the ammonia pressure in the liquor, then ammonia will be absorbed by the latter. And, again, absorption of ammonia increases with decrease of the temperature of the washing water; but the temperature should not be too low, as ethylene and benzene will be thrown out. Another thing is that nothing should be taken for granted on *primâ facie* evidence, but that chemical test should be the arbiter, as, for example, in making an actual test of oxide before finally determining that it is in a condition ready for discharging. In fact, the paper bristles with useful hints—all tending to the one desired end of high efficiency in respect of purifying performance, and reduction of the labour and expense incidental thereto.

Liverpool Gas Company.

There will be general appreciation in the gas profession over the very graceful reference made by Mr. H. Wade Deacon, the Chairman of the Liverpool Gas Company, at the meeting of the proprietors last Tuesday, to the loss of their former chief officer, Mr. Edward Allen. His characteristics as a man, his ability as an engineer, his sound judgment and advice and loyalty as an officer were placed on record; and this was all crowned and accentuated by Mr. Deacon's words: "I felt his death as the death of a friend." However, men pass, and the affairs of life continue their course. Mr. R. E. Gibson is in Mr. Allen's office, and has largely been responsible for the working of the past year, upon the foundations laid by his predecessor. Liverpool is to be congratulated upon the fact that the Company, despite unusual difficulties and the heavy costs in connection with labour and materials, as well as the additional outgoings in other directions, have been able to continue to supply gas at 2s. 1d. per 1000 feet, and have only just been compelled to raise the price to 2s. 3d. The sales of gas have increased considerably during the year; but Mr. Deacon has warned the proprietors that various causes may bring about a reduction of consumption in the near future. If so, it will only be during these war times the very common experience of the suppliers of light, heat, and power.

Freights and Government Defence.

The question of mercantile shipping is, Mr. Runciman says, constituted of a hundred problems, and not of a single one. That may be. The fundamental problem is the shortage of tonnage; and two of the primary reasons for the shortage is that such a large proportion of the tonnage has been commandeered by the Government, and that the Government have not until now made it their business to see that the execution of contracts for new vessels was made a war necessity, in view of their own large requirement. All through this war, we have been labouring under the disadvantage of a want of foresight. With the first matter, Lord Curzon's Committee are now dealing, to see whether anything can be done to economize in the matter of the ships commandeered by the Government. The allegation is that the Government commandeered much too liberally. Mr. Runciman acknowledges that (we suppose this includes torpedoed and mined vessels) there are only available for our mercantile business to-day 67 vessels out of every 100 that were available before the war, and that of the 67 from 21 to 24 are neutral vessels. Naturally, there is a reluctance on the part of the Government to admit that there is waste in connection with the large number of vessels commandeered; but various shipowners had, in the House last Thursday night, some gruesome tales to tell of wasteful use. For example, Mr. Houston stated that half the time of the 450 big ocean-going colliers requisitioned for the Fleet is wasted. No one who heard the allegations coming from men of authority in shipping could escape the feeling that certain Government Departments are not so innocent of blame in this matter as is suggested by their apologists. As to the delayed shipbuilding under pre-war contracts, it is announced that the Government have—now that the country is in a terrible plight with its shipping, and is being heavily bled by high rates of freight—decided to grant facilities for the completion of a tonnage of half-a-million. If the means of producing economy in the ships requisitioned by the Government are supplemented by a reduction of unnecessary imports and new tonnage, and if too means are adopted for the more rapid loading and discharging of vessels at the docks, some relief should be obtained.

Maximum Rates of Freight.

In the discussion in the House, Mr. Balfour stated that the present market rates of freight are preposterously and dangerously high; and Sir Walter Runciman not long since admitted that the cost of freightage was not only scandalous, but a crime. In face of these opinions, the President of the Board of Trade asserts that it is impossible to apply to British vessels maximum rates of freight. Either, he held, the rates must be put up to the world level, in which case the country would get no direct benefit, or so low as to give the country some sort of benefit, but, being so low, the 21 to 24 neutral vessels out of the 67 per cent. of vessels available now as compared with pre-war times would be driven from our ports. In other words, Mr. Runciman contends that the neutral minority compels this country to bear the burden described by Mr. Balfour as "preposterous" and "dangerous," and by Sir W. Runciman as "scandalous" and "a crime." It can hardly be asserted that the President of the Board of Trade made out a good case against maximum rates of freight. Everything he said, only goes to prove, however, that the procrastination of the Government in this matter—a matter which should have been taken in hand as a cardinal one at the beginning of the war—has only made the problem more and more complex. A better defence was made in connection with the charge that this country is largely profiting from the high rates of freights to allied countries—a matter which has been a source of grievance to, among others, British gas companies whose operations are carried on in the countries of our Allies. For instance, it was shown that of the vessels carrying coal from Cardiff to Italy in the three months ending in January, 28 were British, 39 Italian, 35 Greek, and 23 of other nationalities. From the Tyne, half the vessels going to Italy were British, and half foreign. These data, of course, remove from British shipowners the stigma of being solely responsible for the high freights to Italy. The Government have the power of regulation, and so have the French and Italian Governments. Why should they not all use it?

Dye Supplies and Dyers' Profits.

We are not as a rule interested in the financial concerns of dyers' associations or companies. But since the war started, we have heard a lot about the shortness of the supplies of dyes, and of the possible consequences of the stopping of the inflow from Germany of the requisites for the dyeing business. But the country has been marshalling its productive forces; and the gas industry has been backing these up with the intermediate products. This is where interest hinges in matters affecting the production and uses of dyes. With all that we have heard and read, the impression has been deepening that the industries engaged in dyeing must have had a very unhappy time during 1915; but relief from this impression comes with the publication of the report of the Bradford Dyers' Association. It cannot be said that the shareholders of this organization need despair when they learn that, as the result of the trading in 1915, it has been possible to place £168,181 to repairs and renewals; and then, after making provision for income-tax, excess profits duty, and other contingencies, to show a net trading profit of £568,623, to which has to be added £125,882 brought forward. A sum of £90,000 is transferred to depreciation fund, and £10,000 to investments contingency fund; interest is met on debenture stock, dividends are paid on preference stock; and then a dividend of 7 per cent. and a bonus of 3 per cent. are to find their way to the holders of ordinary shares. After this £10,000 is carried to the employees benefit fund, £144,628 to the reserve fund, and £119,861 is carried forward. And yet by those who did not know better, there had been visions of a starving industry, and very lean (if any) profits! Our hopes rise as to being able to do largely without the assistance of the Germans in the dyeing industries after the war. The longer the war lasts, the more self-reliant we shall become; but may the war end quickly, provided it does so properly.

Zeppelin Raids and Street Lighting.

In writing on this subject in the editorial columns last week, it was remarked that it might become of military importance, and a necessity in safeguarding the inhabitants of our cities and towns, in these days of airship raids and bomb-dropping, that means should be adopted by which street gas-lamps can be extinguished and re-lighted promptly without interrupting the private supply. There are such means available; whether they are applicable in all districts, and with all existing canalization systems, is another matter. Last Tuesday—the day that our remarks on the general subject were published—a report came to hand that Rouen and Havre had had their first Zeppelin raid, or rather attempted raid. In Rouen, the electricity supply everywhere was at once cut off; but not so the gas supply. "Some squares," the report says, "where gas is used, remained brilliantly lit for half an hour, when gas men rushed round putting out the lamps." On the other hand, with the electric light, the streets were plunged in darkness, the trams were stopped, and sudden darkness was produced in theatres, shops, and elsewhere. But there was no panic. Rouen is to be congratulated on the level-headedness of its population. A sudden plunging of people in total darkness, especially where a number are gathered together, is a happening that may cause panic. With gas nothing of the kind occurred; only the street lighting was affected. The warning being sufficiently long—and good warning, with proper intelligence organization, it is not impossible for the authorities to arrange for—there was ample time before the Zeppelin was seen (and fortunately driven off) for the gas-lamps to be extinguished in a manner that produced no commotion or danger. And when there are no Zeppelins about, the report acknowledges, the squares are "brilliantly lit" by the gas-lamps.

Trading Possibilities.

If, as we are assured is the case, there will after the war be openings in Russia for practically every class of British manufactured goods, the time is none too soon now for taking in hand the necessary organized preparation for the campaign. There is, indeed, a good deal of lost ground to be made up, before any reference is made to new outlets; for the figures of imports into Russia over the last twenty years can lead one to no other conclusion than that the United Kingdom has been retrograding while Germany has progressed. In other words, Germany has been increasing her trade with Russia at the expense of this country. This is a state of affairs which should, and we hope will, be remedied in the not very distant future—though such hope does not find a great deal to sustain it in a memorandum prepared by the Acting British Consul-General at Moscow which is published in the current issue of the "Board of Trade Journal." In this, the assertion is made that unfortunately there is at present little sign in the United Kingdom of that organized preparation which alone will enable the British trader to reap the full advantage from the opportunity which the end of the war will undoubtedly give to him. Manufacturers will do well to bear in mind the clearly-expressed warning that if the United Kingdom wishes to establish her footing on the Russian market after the war, it is essential to begin to organize now on certain definite lines; otherwise the psychological moment will assuredly be lost. Organization and combination are essential. It must not be said of the future as is remarked by the Acting Consul-General of the past—that "the British trade in Russia belonged to a body of stragglers who were simply swept out of the field by a combination that was far too strong for them." Suggested methods of developing British trade are discussed in the memorandum—local representation, the group agency, commercial banking, establishment of forwarding agents, and an official visit of British merchants. The suggestions made are worthy of careful consideration; and the final sentence of the memorandum will not be overlooked—"that in almost every case when a British firm has gone to the trouble of setting up its own branch or agency in Russia, it has met with unqualified success."

Coal Handling and Carbonization.

In the paper that Mr. James Dickson read before the Scottish Junior Association (Western District) last Saturday, he proved the economy that had been achieved by the new gas-works at Kirkintilloch, and with practically all his points, there is agreement. From the engineering aspect, there can at once be concurrence and otherwise with different features in the design of the works; and on the one point which suggests criticism, there may be certain local modifying circumstances. In nowadays choosing a new site for gas-works, the old rule of placing the works at the lowest level in the district has been altogether superseded by the one of locating works where the greatest economy can be realized in the handling of material; and, complying with this rule, the site may not be at the lowest part of the district. It is so at Kirkintilloch; and economy in the handling of material has fully justified erecting the works at an altitude of about 50 feet above the level of the part of the town where the old works were situated. The point that suggests itself for criticism is the retort-house. For twelve beds of eight single retorts built back to back, a building 96 ft. 6 in. long by 150 ft. 6 in. broad appears, from the distance, to be a structural extravagance. The house has been constructed of such size that a railway runs on either side of the bench—the idea apparently being that, in addition to feeding the flanking coal-stores, the coal can be worked direct from the railway waggons into the retorts. Surely, under modern retort-house practice, a building of less magnitude would have sufficed, and yet economy in carbonization been achieved. Perhaps reasons which are not visible from a mere reading of the paper may account for the choice of this spacious house for such relatively small carbonizing requirement—the retort provision mentioned being now 140 per cent. in excess of the maximum day's make.

New Director of the Gas Light and Coke Company.

The vacancy created on the Directorate of the Gas Light and Coke Company by the recent death of Sir Hugh Owen, G.C.B., has been filled by the election of Sir Daniel Ford Goddard, M.P. for Ipswich, whose name appeared in the New Year's Honours list last month, when he was made a Privy Councillor. Sir Daniel is, of course, exceedingly well known, as he is respected, in the gas profession, with which he has had a life-long connection. For a period of fourteen years, from 1882, he occupied the position (held by his father and grandfather before him) of Engineer and Manager of the Ipswich Gas Company, of which, and of the South African Lighting Association, Limited, he is now Chairman. He is also the Deputy-Chairman of the Tottenham District Light, Heat, and Power Company. Thus he will bring to the more imposing position to which he has now been elected a ripe experience of gas administration under varied conditions. The honour of knighthood was conferred upon him in 1907.

Mr. Samuel B. Clapham (Messrs. Clapham Bros.), of Keighley whose will has been recently proved, left £14,674.

The death has occurred of Dr. C. L. H. Pemberton, who was for many years Chairman of the Banbury Gas Company—a position from which he retired a short time ago. He was eighty years of age, and the senior medical practitioner of the town.

PERSONAL.

Mr. H. Hughes, the Manager of the Buckfastleigh Gas-Works, has been appointed Superintendent of the Devon Gas Association, and will be stationed at Moreton Hampstead. Mr. W. Maddock, the Manager of the South Brent Gas-Works, succeeds Mr. Hughes at Buckfastleigh.

To the names of those associated with the gas industry who have distinguished themselves on the field of battle, is added that of Rifleman B. J. Pugsley (17th London), who has recently been awarded the D.C.M. Prior to the outbreak of the war, he was employed as a technical draughtsman at the Luton works of the Davis Gas-Stove Company, Limited.

Caporal-Fourrier Charles E. Dasnieres has been mentioned at the instance of his Brigade for conspicuous gallantry during the attack of June 6 last in the fighting on the plateau of Quennevières —being the first to enter a dug-out occupied by several Germans. Caporal-Fourrier Dasnieres (who has been wounded during the war) has also received the "Croix de Guerre." In other times, as a member of the firm of V. Dasnieres, of Water Lane, E.C., he has been in the habit of calling at gas-works in this country in connection with the purchase of retort carbon.

Referring to the war, at the annual meeting of the Uxbridge Gas Company. Mr. H. E. Jones (the Chairman) said he wished he could have brought them an example of the savage methods of their enemies; their Assistant-Engineer, Mr. Brough, who had returned, having lost one arm in battle, and the other arm as the result of murderous attacks after he was already a prisoner and wounded. They meant at some future date to do what they could to employ him. He was a standing illustration of the barbarism of the Kaiser, who kept on invoking God Almighty in every address he made to his troops. The King went to see Mr. Brough in hospital, and, knowing his pension would be a very poor one, gave him instant promotion to the rank of Captain, so that he could draw a larger pension.

Income-Tax Law.

A subject which is of more importance now than was the case some years ago, and which it is feared by many may become of even greater importance in the near future, is the law relating to income-tax. In the present time of unprecedented but absolutely necessary expenditure, while no one should wish to escape his due share of the burden of taxation, the income-tax has grown to such proportions that many people who never inquired into the law on the subject before are doing so now, in order to make sure that, under the new legislation, they do not pay more than is legally required of them. Thus it is that the ninth edition of Pratt and Redman's "Income-Tax Law" (by the late J. Tidd Pratt, Q.C., and Mr. J. Haworth Redman, of the Middle Temple, Barrister-at-Law) makes a timely appearance. The book, which is published by Messrs. Butterworth and Co., of Temple Bar, and Messrs. Shaw and Sons, of Fetter Lane, E.C., at the price of 9s. 6d. net, is an analysis of the Income-Tax Acts, with decisions, illustrations, and explanatory notes, and a chapter upon excess profits duty. Without the fifty pages of index, and another fifty pages of tables of cases and statutes, the book runs to over four hundred pages; but that so much space should be necessary for the adequate treatment of a complicated subject will hardly cause surprise to the reader, after noting in Mr. Redman's preface that "the statutory part of Income-Tax Law consists of siftings from the unrepealed portions of the Income-Tax Acts of 1842 and 1853, and from upwards of fifty Acts of a more or less confusing nature which have been heaped upon them."

Sulphuric Acid Prices.—When referring to the subject of the recent order limiting the price of sulphuric acid [*ante*, pp. 351-75] the "Chemical Trade Journal" on Saturday dealt with the "incidental charges" that it was recommended should be made by the acid maker to cover the cost of filling into tanks, carboys, &c. Our contemporary remarked: Whoever is responsible for the calculation of these "incidental charges," one cannot but be struck by his remarkable propensity for fixing upon conveniently round figures. Without seriously disputing the accuracy of the actuarial value placed upon each of the several services which the acid maker will be called upon to perform, the charge of 10s. per ton for filling acid into the consumers' own carboys appears to us to be a not ungenerous rate of remuneration.

Manchester District Institution of Gas Engineers.—At next Saturday's meeting, the business to be transacted (beyond that already noticed on p. 361 of last week's "Journal") will include an informal discussion on the "Carbonization of Pitch." There are five new members to be introduced—viz., Mr. Samuel Carter, of the Garston Gas-Works, Liverpool, Mr. D. H. Davies, of Nantwich, Mr. E. Hargreaves, of St. Anne's-on-the-Sea, Mr. G. W. Houston, of Crewe, and Mr. Herbert Wrigley, the Resident Manager of the Hollinwood Gas-Works of the Oldham Corporation. The report of the Committee for the twelve months to Jan. 31 will be presented, as also the statement of accounts and the reports of the two Commercial Sections. The introduction by the President for the past two years, Mr. J. G. Newbigging, M.Inst.C.E., of his successor, Mr. E. A. Harman, M.Inst.C.E., of Huddersfield, who will be delivering his inaugural address, will be pleasing features of the gathering.

ELECTRICITY SUPPLY MEMORANDA.

Except for particularly favoured electricity supply undertakings in industrial centres, this year is not promising at all well. Costs have been ramping upward, consumption has been moving in the contrary direction, and the circumstances of the time are not propitious to the reaping of new business. In many cases, the first advances in price to the consumers have proved their incapacity to overlap or equalize the additional outgoings; and, in consequence, a second increase has had to be made. In this respect electricity undertakings are not peculiar; some gas undertakings have found it necessary to do precisely the same thing—much to their regret. That a sufficiently generous estimate was not at first made as to what would be required to meet the higher disbursements with a reduced business is not a matter upon which blame can be rightly attached to anybody, seeing that the factors in the situation as they now exist were not of sudden birth at the beginning of the war, but have been of progressive development. Just by way of illustration and nothing more, it may be mentioned that the London Electric Supply Corporation, Limited, have announced a further 10 per cent. increase in their charges. The Hackney Electricity Committee recognize that the charges for electricity must now be advanced by 17½ per cent. on the scale existing in July, 1914; and 2½ per cent. discount will be allowed for payment within 14 days. Some of the London undertakings—Chiswick is one of the latest—have notified their customers that they must insist, where the account is not in excess of the figure, on collecting the minimum of 13s. 4d. per quarter allowed by their Provisional Orders. The Brighton Electricity Department is not alone in now having a desire for flat-rates. At Eccles, it is proposed to charge large users a flat-rate of 3d. per unit for a consumption exceeding 10,000 units per annum through one service; the accounts to be subject to 10 per cent. discount. At Salford the price is to be advanced from the 7½ per cent. previously decided upon to 10 per cent. for lighting and 15 per cent. for power. The Reigate Town Council have resolved to raise the price of current for heating from 1d. to 1¼d. per unit; and the occupiers of the Corporation flats at Gillingham are now to pay 8d. per week, instead of 6d. So goes on the necessary game of trying in every direction of business to make things balance through the consumer; but there must come a point at which the masses of the people find outlay has accumulated to such an extent that they perforce must begin to try to counterbalance things by economizing. The lessons of these times will have their effect after the war upon the modes of living of numbers of people.

Making Both Ends Meet.

Where Wealth Abounds.

Not even St. James' and Pall Mall are exempt from the influences of the war. Wealth and luxury are very nice in their way. But they cannot resist the deep impressions that war conditions are making in every direction; and so the St. James's and Pall Mall Electricity Supply Company, with a magnificent lighting load, are finding their happy results of peace times being considerably interfered with. The top line of net profits ("Electrical Industries" states) was reached by the Company in 1913, when the figure was £31,042. In that year the distribution on the ordinary shares was 12 per cent. In 1914, the net profit was down by something like £4000, or to £27,133; and the dividend was shorn of 2 per cent. Now for 1915 the net profit is only £14,335. But by transferring £4500 from the contingency fund, a dividend of 8 per cent. can be paid (against 12 per cent. in 1913), and £2752 be left to be carried forward. The sale of units in 1913 was 11,605,000; and last year, 10,674,000. The Central Electric Supply Company (who produce current in bulk for the Westminster Electric Supply Corporation, the St. James's and Pall Mall Company, and the Chelsea Electricity Supply Company) succeeded last year in making a net balance of £1, compared with £4998 in 1914. No dividend is now being paid; while 5 per cent. is the usual distribution.

Can We Forget?

Mr. A. P. Trotter has made his report to the Board of Trade on the smashing by a motor car (which swerved from the road) of an electric switch-pillar at Eastbourne, on Dec. 26 last, whereby two men who tried to render assistance lost their lives through electric shock, and several other good-natured persons, with an equal knowledge of the performances of electricity, also, at some personal inconvenience, acquired certain knowledge as to its potentialities. An attempt was made to rescue, by the use of a wire rope, the two men who were killed. Had a hemp rope been used, the day being dry, the men might have been rescued, or they might have been pulled away by the loose parts of their clothing; and if, after getting them clear, the well-known means of artificial respiration had been practised, the lives of the men might have been saved. Mr. Trotter makes certain recommendations. This electric-switch pillar-box stood on the edge of the footpath, which was not provided with a curb. Obviously, says Mr. Trotter, the switch pillar-box should be placed farther from the side of the road, better in side streets than in main thoroughfares, and better still if accommodation can be found for them in the walls of houses or gardens. Among other recommendations the "Electrical Review" finds three which, it thinks, reflects "that spirit which, before the war, could be discerned in so many official decrees, especially in connection with electrical undertakings of every description." It refers to "the bureaucratic tendency continually to impose fresh burdens upon them, to add to the multitude of restrictions by which they are bound." The proposals, which are designed to protect the public, are, from the engineering point of view, simple, and could be made perfectly safe. They are that a curb, not less than 6 inches in height, should extend not less than 10 feet on each side of the pillar; where pillars are set near a curb, feeders or "spurs" of rounded blocks of stone or strong iron castings could be usefully set at the corners of the pillars facing the road; and cast-iron pillars should be reinforced by a cage of wrought-iron rods, or an inner lining of sheet or expanded metal or wire mesh should be attached to the pillar and to the doors, and the pillar should be connected to a substantial earth plate, as well as to the head of the cables. Our contemporary comments: "Why all this panic? Men and women are dying in hundreds around us—in the Metropolitan area alone on the average three persons are killed every day by vehicles, and nearly eighty are injured; but no suggestion is made to fit all vehicles with pneumatic buffers, or provide pedestrians with compulsory crinolines." These words are in the paper which published the celebrated "Lest we Forget" article in connection with a certain railway accident, the writer of which article appeared to have had his slumbers seriously disturbed by the part which, he was under the impression, gas had in such accidents. The same contemporary does not publicly confess to suffer the same amount of anguish when there are certain terrible occurrences that are without any shadow of doubt attributable to electricity. Mr. Trotter may remember the "Lest we Forget" article, and ask himself "'Why all this panic?' over my simple proposals in the interests of the public?" For our own part we cannot see any analogy between the hundreds of thousands of fast-moving vehicles in London streets, and widely spaced fixed switch pillar boxes of an electricity distribution system.

Unreliable Cookers.

Evidently the Gillingham Town Council are not altogether satisfied with the fallibility of electric-cookers. In future, it seems, they wish to keep clear of having any obligation upon them in respect of the maintenance of such apparatus. They have resolved that, "owing to the difficulty of obtaining supplies of reliable apparatus, no more electric-cookers are to be issued until a hire-purchase scheme is introduced after the war. But the existing cookers are to be maintained as at present." It is obvious from this that the Council are desirous hereafter of only doing business in electric-cookers on the hire-purchase system, and to shift maintenance, &c., from their own shoulders on to those of the people who are soft enough to put their trust in electricity for culinary operations. The wife of a gentleman intimately interested in an electricity undertaking was not a great while ago heard to remark in a gas-showroom: "My husband insists on an electric-cooker staying in my kitchen; but I have insisted on having a gas-cooker there as well." Reliability and time were the factors that told in favour of the latter in that case. The accounts were paid by the husband. Even the "shrinkage of meat" fiction had no effect on the lady.

A Blessing in Disguise.

People have different ways of looking at things, and of expressing themselves in regard to them. The Hastings Corporation Electricity Committee recently applied to the Local Government Board for sanction to the borrowing of £500 for the provision of house services for electric lighting. But the only satisfaction the Committee got was to be told that the Board confirmed the circular sent out last March, in which it was stated that they were not now sanctioning any loans save for matters of pressing necessity, for reasons of public health, or else on account of war requirements. At a recent meeting of the Corporation, Alderman Chesterfield said he thought this was rather a "serious matter;" but perhaps it was a "blessing in disguise," because it showed the futility of applying for loans except for matters of public health. He left his hearers to choose between the "serious matter" and the "blessing in disguise." We rather think the alderman himself is in favour of the "blessing in disguise," because he added "they would not for years see a loan granted except for matters of public health." This will certainly be a "blessing in disguise" for those electricity undertakings that have not shown up well in the matter of economical and productive expenditure.

Breakdowns.

The fresh crop of breakdowns of electicity supply which we recently noticed have not in all cases had their causes explained. The causes of such interruptions are varied—in fact, there seems to be no end to them. Reports have been issued as to the breakdown at Wallasey and the more imposing one at Wigan. At Wallasey, the trouble was in connection with the new power station, and was due to the stoppage of the circulating water. Three days were required in order to set things right. At Wigan, the cessation of supply was due to the overstraining of the plant, through excessive demand—the scene of the mischief being the boiler-room. The breakdown took place on Jan. 22. The lighting supply was available on the following day; the power supply on Monday, Jan. 24; but the trams were not in full running until Jan. 27. Altogether, electricity supply has been in for a bad time lately in the matter of its propensity for leaving people in the lurch, and the people who have been left in the lurch have not deemed themselves fortunate.

Losses from Electric Water-Heaters.

Perpetual care must be taken with heating by electricity to see that the thermal losses are reduced to a minimum. This point is hammered into people on every possible occasion, and in connection with every form of electric heating apparatus. It is a necessity enforced by the low thermal value of electricity relative to its cost. The heating efficiency of an electric appliance has no relation whatever to the terrific loss of B.Th.U. that occurs in getting heating energy in the form of electricity to the apparatus. The amount reaching the apparatus is a very slight proportion of the heat units of the fuel placed under the boilers at the electricity station. We see the care enjoined in connection with electric-ovens, which should be thickly lagged, practically unventilated, and the doors should never be opened while food is being cooked. Electric-fires, too, should be used in rooms without chimneys, so as to lose as little as possible of the precious heat; and electric water-heaters should be made so that the heating elements are like islands surrounded by water, and then what heat is lost will not be chargeable to the elements but to the water. All through we see the devoted anxiety necessitated by circumstances. Herr Rittershausen in the "Electrotechnische Zeitschrift" has been writing on the subject of the losses in electric water-heaters. So precious, we see, is the heat that none should be lost through the escape of steam. He therefore prefers the closed type of apparatus, which can be heated up to a temperature of (say) 90° C. [194° Fahr.]; this being the highest temperature which allows the water to be heated without "serious" loss of steam. This is because the apparatus is closed and under pressure. The open type loses much heat because steam passes off at temperatures much below the boiling-point. Water expands by 3·5 per cent. between 10° C. and 90° C. This volume is lost, and escapes in the open type, while it presses the cold water backwards in the closed type. Naturally his fancy is for the immersed heater. In types with the heating element at the sides or bottom of the heater, he gives precedence to the side fixing, and not the bottom, because the deposit from the water causes the work of the heater to become increasingly unfavourable. The hot water, too, is generally cloudy, owing to continual agitation of the sediment. A "very serious" loss is that which occurs through the metallic connections between the water-container and the external casing or the air. The loss due to the inflow-pipe can be lessened by having a cold zone in the bottom of the boiler. The outflow-pipe must naturally be connected so as to draw water from the top of the boiler. Herr Rittershausen recommends, as a simple remedy against loss, the bringing of the outlet-pipe vertically downwards through the heater, and so allow the water to pass out of the bottom. But what about the chilling effect on the water in the outlet-pipe through the loss to the cool zone of water (through which the inflow-pipe is made to pass), unless the pipe is taken out laterally before reaching this point? As it is necessary to maintain as large a supply of hot water as possible at the top of the boiler, baffle-plates should be employed, so as not to allow eddies to be set up. If an electric boiler can be made with a mean efficiency of between 90 and 94 per cent., Herr Rittershausen contends that it can compete with boilers heated by other means, if energy can be obtained at ½d. per unit; but, if the efficiency is lower, then the cost of the energy must also be lower. Other authorities put the essential competing cost at a lower figure still; and they are right. There are other than heat losses in connection with electric water-heaters. There are the losses of time and temper, and the losses of household efficiency and general convenience through not being able to obtain large supplies of heated water quickly as well as economically.

The "Cambridge" Optical Pyrometer.

Among the many pieces of apparatus of the Cambridge Scientific Instrument Company which are found extremely useful in gas-works practice may be mentioned the "Cambridge" optical pyrometer, for reading temperatures of from 700° to 4000° C. This appliance is the subject of an illustrated descriptive leaflet just issued by the Company, in which the statement is made that it can be used by any person without technical knowledge, and on account of its construction accurate observations can be taken repeatedly by different operators. The measurements are based upon the formula of Professors Paschen and Wien for the relationship between light intensity and temperature; the constants for each instrument being individually determined before calibration. Behind an enlarged part in the front of the pyrometer, in which is fitted the electric lamp, there are two holes. Light from the object under observation passes through one, and light from the lamp through the other. These beams of light then pass through a system of lenses and prisms, are polarized in different planes, and rendered monochromatic. Finally, the two beams of light pass through a single ocular. The observer sees an illuminated circular field divided into two semicircles—one filled by an image of the hot body under observation, and the other uniformly illuminated by the electric lamp. The two semicircles are brought to an equal intensity of illumination by turning the eye-piece to which the scale-pointer is directly attached. In this manner, the unknown rays are compared with those of known intensity from the electric lamp.

CARBONIZATION OF COAL IN GAS-WORKS.

Vertical Retorts at Alloa.

Much practical information with regard to the distillation of coal in vertical retorts was contained in a paper which was read by Mr. J. W. Napier, of Alloa, before the Edinburgh and East of Scotland Section of the Society of Chemical Industry, at a meeting which took place in Edinburgh last Wednesday. In view of the fact that his paper was addressed to an audience that, generally speaking, might not have very intimate association with the gas industry, he did well to emphasize in his opening remarks the important place among the manufactures which the industry holds, especially when considered in connection with the bye-products. This done, he proceeded directly to the subject of the paper—the very considerable and real progress which has been attained during recent years in the manufacture of coal gas and bye-products, especially as regards the economics of the industry. As to the future of the economics of gas production and of residuals, this, he asserted, lies almost entirely in the domain of the chemist. "It has been imputed," he said, "that in gas manufacture the chemist has not succeeded in any very measurable degree in enhancing the value of gas-works methods, and that his investigations are only explanatory of what is taking place, and not inventive of new methods. This declaration bears a false meaning, because undoubtedly the chemist has given knowledge and understanding, without which there would not be the same high degree of efficiency as that already reached. Between the pure scientist and the manufacturer there arises too frequently as a barrier the commercial side of the business; and this aspect of the situation accounts for much."

For nearly two years past, the whole of the gas required at Alloa has been produced in vertical retorts; and some particulars of the six beds of four retorts each (24 in all) which have been installed, were given in the paper, with a plan and some photographs indicating clearly the arrangement of the complete plant. The retorts are on the continuous-intermittent system; and the overhead coal storage hoppers have a capacity equal to 48 hours' requirements. From the experience Mr. Napier has gained, he would not advise hoppers of a less size than this. There are overhead coke-hoppers for the supply of fuel to the producers; and the same capacity has been arranged for in this case. It was pointed out that the outstanding feature of coal-carbonizing plant on the vertical system is the absence of machinery for the charging and discharging operations; the law of gravity having been fully taken advantage of, with the result that there is "a combination of conditions of working and economy in labour costs never before approached." At Alloa, the output for which 88 horizontal retorts were needed is provided by twelve vertical retorts.

One matter to which the author drew attention was the considerable flexibility in the working of the retorts as regards throughput; and in this connection he related his experience of the past year. It seems that in the summer months twelve retorts were in use for a daily output of 320,000 to 350,000 cubic feet; the make per retort per 24 hours being from 27,000 to 30,000 cubic feet. During the past winter the same number of retorts have sufficed to meet the daily demand of 600,000 to 650,000 cubic feet; the make of gas per retort per 24 hours having increased to 53,000 cubic feet as a maximum. As a matter of fact, the average figure for November was 48,967 cubic feet. The same number of men, oo, were employed at the maximum time of output as at the minimum. These results were effected by increasing the temperature of the retorts, giving a larger throughput of coal, and by judicious admission of steam, whereby a quantity of water gas was made; the amount of steam used being governed by the necessity of preserving a certain standard quality of gas.

Dealing with the matter of saving, in figures, Mr. Napier stated that, for a complete working year with horizontal retorts and machine charging only, with hand drawing of coke, stokers' wages amounted to £1825, or 2s. 2¾d. per ton of coal carbonized, and ·82d. per 1000 cubic feet of gas made. In twelve months with verticals, stokers' wages were £702, or 1s. 0½d. per ton of coal, and 1·1d. per 1000 cubic feet of gas. This represents a saving of £1123, with practically the same output of gas. In the case of the vertical retorts, too, the wages cost includes all handling of coal and coke, labour at boiler for steam-raising for the whole works supply, cleaning of producers, and other work. Two men only are employed per shift of eight hours; in fact, during the night and on Sundays these are the only employees who are left on the works.

Results of working tests, using Blairhall nuts, were quoted; and these showed a make per ton of coal (corrected) of 12,180 cubic feet. In a comparison of the chief results of working as between horizontal and vertical retorts (the data being obtained over a complete twelve months' working), the figures of gas made per ton of coal were 11,455 cubic feet in the case of the verticals, and 468 cubic feet for the horizontals. In order to present the matter in as clear a manner as possible, the author also quoted a careful calculation made by him of the exact amount of increased value obtained from a ton of coal in vertical retorts, including wages economy (but taking no account of the saving in repairs and maintenance of plant). This increased value per ton of coal he finds to be: Gas, 2½d.; tar, 8¾d.; sulphate of ammonia, ¾d.; coke, 1s. 1½d.; saving in wages, 1s. 2½d.—or a total of s. 7¾d.

Mr. Napier explained in the course of the paper that, with the continuous-intermittent system, the outstanding feature of advantage is undoubtedly the quality of coke produced, as regards its physical condition. It is, he said, conceded that, in order to make coke of high quality, as, for example, in the coke-oven, a period of rest for the material in the retort is a necessity. The quality of the coke as regards appearance, size, and small quantity of breeze made, is distinctly in favour of this system; and the advantage in this respect is, in his experience, considerable. Even in practical working with the intermittent retorts, it has been found by him that when the coke was discharged more frequently in small quantities in from one to two hours, instead of four to five hours, there was a marked difference in the size of the coke, which was undoubtedly due to the absence of the period of rest-time. The moisture content with this system is not more than 1 per cent.; while analyses which were set forth in the paper showed that the quality of vertical retort coke compares most favourably with the special coke prepared for malting purposes. Mr. Napier stated that it has been in use during the past twelve months in a number of breweries, and that there is no reason why gas-works having vertical retorts should not be able to meet the requirements of brewers in the matter of coke. Another purpose for which it is suitable is for suction producers; the very small quantity of volatile matter present obviating tar troubles in the working of gas-engines. The quality of vertical-retort tar, he went on, shows it to be more a product of low-temperature distillation; and it contains a large amount of paraffins and less benzene and toluene. As a product of a higher temperature, horizontal retort tar contains a much larger percentage amount of the aromatic hydrocarbons; and the necessity of changing the character of the vertical-retort tar in view of the present urgent need for benzene and toluene, is a subject demanding experimental investigation.

Some attention was devoted by the author to nitrogen in coals and the ammonia yield; it being pointed out that the results of tests by him of coal for nitrogen, are in agreement with what has been found by other observers—that the nitrogen content of a coal is no reliable guide to the ammonia yield on carbonization. From 50 to 65 per cent. of the nitrogen in the original coal is left in the coke. An analysis of vertical retort coke gave 1·54 per cent. of nitrogen—equal to 34·49 lbs. of nitrogen, or 162·6 lbs. of sulphate of ammonia, per ton of coke. There is a difficulty here; and Mr. Napier said that the problem which now presents itself is the possibility of the recovery of a larger proportion of the nitrogen left in the coke under gas-works conditions. It may, he remarked, be stated quite safely that any attempt to recover a large amount of the total available can only be made by complete combustion of the coke. Allusion was made to the experiments over thirty years ago of Tervet, and to what has been accomplished by the Mond process; the result of due consideration of the matter being to bring the gas manufacturer back to the problem of increasing the ammonia yield from the coke before it leaves the retort.

For the purpose of ascertaining what higher yield of ammonia it was possible to obtain by passing steam into the mass of red-hot coke at the bottom of the vertical retort, the author adjusted the heating of the retorts so as to have a comparatively low temperature at the top for a distance from 6 to 8 feet down; while the temperature near to the bottom, except for the last 3 to 4 feet, was increased in order to ensure the decomposition of the water vapour in the mass of red-hot coke. The amount of steam used was limited by the quantity of water gas produced, and the need for maintaining the illuminating properties of the gas without too much enrichment. The use of steam, therefore, was intermittent; and it was not possible to obtain the advantage of anything like an excessive amount, which would have helped to protect the ammonia. However, even under these conditions, the yield of ammonia for a complete month's working showed a small increase. Without steam, under normal conditions, the production of sulphate of ammonia per ton of coal was 25·88 lbs.; with steam, it was 27·86 lbs. At the same time, the make of gas per ton of coal was increased to 13,164 cubic feet.

With restrictions as to illuminating power and heating value of the gas, it is, concluded Mr. Napier, fairly evident that the conditions existing in the retort are opposed to anything like a large increase in yield of ammonia being obtained. He is, however, of opinion that catalysis will probably in the end afford a surprising result. While admitting that surmise of this kind may not be very hopeful, he pointed out that in not a few technical processes on the large scale, it has been found that the presence of a suitable catalyst has yielded most unexpected results. During the last three years of his working with horizontals, Mr. Napier experienced an exceptionally large amount of cyanogen in his gas, due to high temperatures, owing to shortage of carbonizing plant, and perhaps unevenness of the layers of coal in the retorts; but since the verticals have been in operation, all traces of an excess of cyanide have disappeared.

The Committee of the Privy Council for Scientific and Industrial Research have appointed the Hon. Sir Charles A. Parsons, K.C.B., F.R.S., a member of the Advisory Council, in place of Professor Bertram Hopkinson, F.R.S., who has been forced to resign by the pressure of his military duties and special work connected with the war. They have also appointed Professor Jocelyn Field Thorpe, F.R.S., to fill the vacancy on the Advisory Council caused by the death of Professor Raphael Meldola, F.R.S.

COMPARATIVE WORKING RESULTS OF THE THREE METROPOLITAN AND FOUR OF THE SUBURBAN GAS COMPANIES.

IN THE HALF YEAR ENDED DEC. 31, 1915.

Compiled by Mr. F. J. BRADFIELD, the Secretary of the Commercial Gas Company.

——		Gas Light and Coke.	South Metropolitan.	Commercial.	Brentford.	Wandsworth.	South Suburban.	Tottenham.
Gas sold	thousands	12,905,757	6,218,421	1,677,383	1,885,501	1,204,737	1,027,770	1,171,289
Increase	per cent.	1·40	Dec. 2·03	1·48	4·43	0·52	1·01	4·89
Gas made per ton of coal	cubic feet	12,791	12,278	13,956	12,229	12,507	12,592	12,451
" " per gallon of oil	"	403	..	449	480	398	427	405
Gas unaccounted for	per cent.	5·58	6·92	9·40	7·48	6·30	9·67	11·75
Coke made for sale per ton of coal	cwt.	9·96	9·38	11·16	10·46	11·10	10·17	9·32
Tar made per ton of coal	galls.	9·89	9·67	11·36	11·05	9·32	10·50	..
Liquor made per ton of coal	galls, 8 oz.	37·48	40·77	36·27	33·06	35·20	37·34	33·31
Percentage of coke used as fuel		19·70	24·02	10·74	16·19	11·16	21·78	24·47
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Capital expended per 1000 cubic feet sold during the past year		11 0·12	8 5·81	8 6·39	7 2·36	7 9·24	9 10·25	8 8·05
Price charged per 1000 cubic feet		3/0 and 2/10	2/10	2/8	2/4 to 3/6	2/1 to 3/1	2/10 to 4/7	2/3 and 2/11
Costs per 1000 Cubic Feet of Gas Sold.								
REVENUE ACCOUNTS.		d.	d.	d.	d.	d.	d.	d.
Coals, oil, &c.		19·76	24·95	17·41	18·93	19·52	24·48	19·22
Less residuals—Coke and breeze		7·38	10·62	6·66	5·83	9·10	9·59	5·61
Tar		1·54	2·53	1·48	1·27	1·42	1·54	0·71
Amm. liq. and sulph. amm.		2·24	2·18	1·90	1·02	2·20	2·39	1·24
Total residuals		11·16	15·33	10·04	8·12	12·72	13·52	7·56
Net for coals, oil, &c.		8·60	9·62	7·37	10·81	6·80	10·96	11·66
MANUFACTURE—								
Salaries		0·30	0·74	0·44	0·48	0·31	0·62	0·30
Wages—carbonizing		1·90	2·01	1·66	1·53	1·98	1·31	1·63
Purification		0·22	0·48	0·15	0·31	0·13	0·22	0·31
Repairs—plant		4·87	3·84	4·39	4·05	4·92	3·68	4·00
Net manufacture		15·89	16·69	14·01	17·18	14·14	16·79	17·90
DISTRIBUTION—								
Wages and salaries		1·18	0·89	0·85	1·01	1·28	1·64	0·92
Repairs—Mains and services, &c.		1·79	1·46	1·47	1·20	3·04	2·27	2·63
" Meters and prep. meters and fittings		1·98	2·44	2·05	0·95	0·83	3·33	1·70
" Stoves—ordinary and prepayment		1·99	1·33	1·67	1·66	1·59	2·94	1·29
Total net manufacture and distribution		22·83	22·81	20·05	22·00	20·88	26·97	24·44
Public lamps—lighting and repairing		0·54	0·59	0·39	0·40	0·50	0·81	0·36
Rents, rates, and taxes		3·34	2·28	2·35	1·93	1·04	1·79	2·24
MANAGEMENT—								
Directors, Auditors, and salaries (Secretary, &c.)		0·27	0·26	0·33	0·42	0·58	0·86	0·48
Collectors		0·54	0·68	0·79	0·52	0·50	0·59	0·47
Stationery and general charges		0·31	0·65	0·58	0·30	0·44	0·52	0·49
Profit-sharing		0·09	0·27	0·34	..	0·42	0·23	0·41
Bad debts		0·14	0·09	0·05	0·10	0·07	0·09	0·03
Law and parliamentary charges		0·01	0·08	0·02	0·02	0·04	0·07	0·04
Superannuations, &c.		0·51	0·65	0·36	0·51	0·41	0·58	0·34
National Insurance		0·08	0·09	0·07	0·06	0·08	0·08	0·05
Active service allowances and war bonus		0·13*a*	1·22	0·35*a*	1·20	1·57	1·09	1·15
Sundries		0·04	0·03	0·03	0·00	0·01	..	..
Total expenditure (*less* residuals)		28·83	29·70	25·71	27·46	26·54*e*	33·68	30·50
GAS		35·31	33·23	31·15	28·35	28·93	37·42	27·49
Rentals—Meters and prep. meters and fittings		3·18	3·34	2·99	4·25	2·98	2·38	1·99
Stove		1·47	1·49	1·88	1·19	2·54	1·98	4·25
Incand. mantle maintenance		..	..	0·10	..	0·14	..	0·11
Miscellaneous		0·11	0·06	0·00	0·01	0·07	0·10	0·06
Total—Gas, rentals, &c.		40·07	38·12	36·12	33·80	34·66	41·88	33·90
Balance, being profit		11·24	8·42	10·41	6·34	8·12	8·20	3·41*g*
Dividend and interest		10·16	7·30	8·47	7·32	7·06	7·91	5·66
Surplus		1·08	1·12	1·94	Def. 0·98	1·06	0·29	Def. 2·25
Contributions to funds and sundry payments		0·74*b*	0·39*c*	..	0·28*d*	0·37*f*	..	0·30*h*
SUNDRIES.		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Coals cost per ton		21 4·85	23 4·82	19 8·69	..	19 6·77	..	20 11·58
Coke realized per ton of coal		8 10·85	9 8·13	9 9·15	9 1·12	10 0·47	11 4·68	8 4·82
Coke " " of coke		17 10·59	20 7·60	17 5·98	17 4·55	18 0·97	22 4·88	18 0·33
Breeze " per ton		4 4·74	4 2·77	3 10·31	5 4·09	1 11·98	5 0·42	0 8·62
Tar realized per gallon		0 2·42	0 2·94	0 2·03	0 1·78	0 1·91	0 2·11	0 1·45
Amm. liquor, &c., realized per butt (8 oz.)		5 9·04	5 4·93	8 6·53	5 3·58	7 7·74	8 3·97	6 0·42
Percentage of stoves at rental to consumers		82	99	72	97	92	100	70
Bad debts per cent. on total receipts.		0·28	0·17	0·12	0·22	0·15	0·16	0·8
Net profit per cent. on ordinary capital		4·82	5·28	6·16	4·66	6·98	5·06	2·42*g*
One penny variation equals in half year		£53,774	£25,910	£6989	£7856	£5020	£4282	£4880
Carb. water gas, per cent. on total make		23·47	..	31·23	41·39	15·40	21·97	40·11

a On Active Service Allowances only.

b Writing-down Consols Special Purposes and Redemption Funds.

c Insurance Fund.

d Writing-down Investments and Stamp Duty.

e Capital Duty eliminated.

f Capital Duty.

g Including Electricity Profits.

h Cost of Converting Consols.

COMPARATIVE WORKING RESULTS OF THE THREE METROPOLITAN AND FOUR OF THE SUBURBAN GAS COMPANIES.

TABLE SHOWING THE VARIATION, INCREASE OR DECREASE, ON FIGURES OF CORRESPONDING HALF YEAR, 1914

[The figures in heavy type show the decreases.]

Compiled by Mr. F. J. BRADFIELD, the Secretary of the Commercial Gas Company.

—		Gas Light and Coke.	South Metropolitan.	Commercial.	Brentford.	Wandsworth.	South Suburban.	Tottenham.
Gas sold	thousands	178,716	**129,187**	24,514	173,912*	6,238	10,312	54,602
Increase (variation equal to)	per cent.	6·12	2·26	5·24	2·68	**·28**	·86	4·68
Gas made per ton of coal	cubic feet	371	**336**	159	116	112	**505**	**475**
,, ,, per gallon of oil	,,	**39**	..	**13**	11	23	**34**	**33**
,, unaccounted for	per cent.	**1·06**	·33	1·11	·90	**48**	·92	3·39
Coke made for sale per ton of coal	cwt.	·13	·42	·07	·33	·25	**·26**	·06
Tar made per ton of coal	galls.	**·61**	·16	·27	**·05**	·06	·78	..
Liquor made per ton of coal	galls, 8 oz.	·97	**·64**	**3·35**	**2·39**	**3·75**	**1·97**	**·58**
Percentage of coke used as fuel		**·65**	**3·35**	**·51**	**2·79**	**2·02**	2·01	**·78**
Capital expended per 1000 cubic feet sold during the past year		s. d. 0 0·83	s. d. 0 5·48	s. d. **0 0 82**	s. d. 0 0·07	s. d. 0 4·50	s. d. **0 0 32**	s. d. **0 1·26**
Price charged per 1000 cubic feet†		0 6·00	0 8·00	0 4	..	0 4·00	0 7 00	0 3·00
Costs per 1000 Cubic Feet of Gas Sold.								
REVENUE ACCOUNTS.		d.	d.	d.	d.	d.	d.	d.
Coals, oil, &c.		4·58	9·69	1·92	3·91	2·26	7·45	3·87
Less residuals—Coke and breeze		2 58	4·90	1·96	2·01	2·91	4·36	1·76
Tar		·25	1·41	·12	**·01**	**·05**	·07	**·37**
Amm. liq. and sulph. amm.		·83	·05	·44	·24	·52	·82	·29
Total residuals		3·66	6·36	2·52	2·24	3·38	5·25	1·68
Net for coals, oil, &c.		·92	3·33	**·60**	1·67	**1·12**	2·20	2·19
MANUFACTURE—								
Salaries		·00	·03	·02	**·01**	·00	**·03**	·01
Wages—carbonizing		·18	·15	·11	**·01**	·00	·02	·19
Purification		**·03**	**·19**	**·01**	**·10**	·02	·08	·02
Repairs—plant		·89	**·22**	**·08**	**·05**	·69	·46	·85
Net manufacture		1·96	3·10	**·56**	1·50	**·41**	2·73	3·26
DISTRIBUTION—								
Wages and salaries		·06	·08	·08	**·26**	**·08**	·21	**·09**
Repairs—Mains and services, &c.		·03	·04	·07	**·81**	1·18	**·47**	**·61**
,, Meters and prep. meters and fittings		·00	·19	**·05**	**·19**	**·22**	1·05	**·23**
,, Stoves—ordinary and prepayment		·02	**·01**	·09	**·20**	**·02**	1·43	·02
Total net manufacture and distribution		2·07	3·40	**·37**	·04	·45	4·95	2·35
Public lamps—lighting and repairing		·00	·01	**·01**	**·10**	**03**	**·04**	**·05**
Rents, rates, and taxes		·14	·04	·06	**·03**	·00	**·06**	·32
MANAGEMENT—								
Directors, Auditors, and salaries (Secretary, &c.)		·01	·00	·00	**·02**	·00	·02	**·04**
Collectors		·03	·03	·04	**·02**	·02	·03	**·02**
Stationery and general charges		·02	·05	·08	**·05**	**·22**	**·07**	**·07**
Profit-sharing		**·23**	**·49**	**·20**	..	**·08**	**·31**	**·13**
Bad debts		·03	·02	**·01**	·02	·01	·04	**·01**
Law and parliamentary charges		**·01**	·05	**·03**	**·68**	·04	·06	·01
Superannuations, &c.		**·15**	·29	**·01**	**·01**	**·30**	**·10**	**·25**
National Insurance		·00	·03	·00	·00	**·02**	**·01**	**·01**
Active Service Allowances and War Bonus		·13	1·22	·35	1·20	1·57	1·09	1·15
Sundries		·00	·00	·01	·00	·00	..	..
Total expenditure (*less* residuals)		2·04	4·65	**·09**	·35	1·44	5·57	3·25
GAS		4·76	6·25	3·65	·20	3·89	5·80	2·21
Rentals—Meters and prep. meters and fittings		·00	**·01**	**·10**	·48	·01	**·16**	**·05**
Stove		·05	·03	·08	·05	·18	·20	·30
Incand. mantle maintenance		..	..	**·02**	..	**·19**	..	**·04**
Miscellaneous		**·01**	·00	·00	·00	·00	·04	·00
Total—Gas, rentals, &c.		4·80	6·27	3·61	·73	3·89	5·88	2·42
Balance, being profit		2·76	1·62	3·70	·38	2·45	·31	**·82**
Dividend and interest		**·97**	**·47**	**·90**	·04	**·25**	**·88**	**·67**
Surplus		3·73	2·09	4·60	·34	2·70	1·19	**·15**
Contributions to funds and sundry payments		·55	·39	..	**·12**	**·01**	..	**·24**
SUNDRIES.		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Coals cost per ton		5 3·03	8 7·25	1 10·30	..	2 6·65	..	2 9·34
Coke realized per ton of coal		2 11·29	4 1·65	2 10·74	3 0·96	3 8·95	5 1·29	2 8·39
Coke ,, ,, of coke		5 9·01	8 3·16	5 1·41	5 6·09	6 5·78	10 4·33	5 8·59
Breeze ,, per ton		2 2·90	3 11·77	0 5·43	0 11·76	**0 1·60**	..	..
Tar realized per gallon		0 0·51	0 1·57	0 0·07	**0 0·07**	**0 0·03**	**0 0·10**	**0 0·34**
Amm. liquor, &c., realized per butt, 8 oz.		0 3·79	0 0·37	2 5·56	1 5·86	2 8·39	3 0·86	1 5·22
Percentage of stoves at rental to consumers		3	2	4	..	3	5	8
Bad debts per cent. on total receipts		·01	·00	**·03**	·02	·00	·04	**·03**
Net profit per cent. on ordinary capital		1·87	·88	2·49	**5·29**	2·72	·18	**·94**
One penny variation equals in half year		£745	**£538**	£102	£724	£26	£43	£227
Carb. water gas per cent. on total make		**3·10**	..	**·78**	**·58**	4·75	3·0	4 00

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* This figure represents the variation on the absorbing Company's own figures, and not on those of the amalgamating Companies, whereas on the preceding table the increase on the "Gas Sold" is on the amalgamated figures.

† These figures show the increases in price in the Companies' principal areas.

METROPOLITAN GAS REFEREES' NOTIFICATION.

Alterations for 1916.

Various alterations are contained in the "Notification" for the current year of the Metropolitan Gas Referees, of which we have received an advance copy. In the first place, there are twelve testing-stations in the area of the Gas Light and Coke Company, instead of fourteen as formerly; the two removed from the list being the offices of the London County Council, Spring Gardens, and No. 1, Vinery Villas, North Bank, Regent's Park. There are some alterations in the following section—the varied portions being printed in italics.

Mode of Testing for Sulphur Compounds other than Sulphuretted Hydrogen.

This testing shall be made on such days as the controlling authority shall direct. [London Gas Act, 1905, section 5 (5).] The apparatus to be employed is to be set up in a room or closet where no other gas is burning. The gas shall pass through a meter by reference to which the rate of flow can be adjusted, and which is provided with a self-acting movement for shutting-off the gas when 10 cubic feet have passed.

Pieces of sesquicarbonate of ammonia, from the surface of which any efflorescence has been removed, are to be placed round the stem of the burner. The index of the meter is to be then turned forward to the point at which the catch falls, and will again support the lever-tap in the horizontal position. The lever is made to rest against the catch so as to turn on the gas. *The index on the long hand is turned forward through nearly four turns, and the burner lighted. When the index is close to zero and the unit hand at 4 the trumpet-tube is placed in position on the stand and its narrow end connected with the tubulure of the condenser.* At the same time the long chimney-tube is attached to the top of the condenser.

As soon as the testing has been started, a first reading of the aerorthometer is to be made and recorded, and a second reading as near as may be to the time at which the gas is shut off. The rate of burning, which with practice can be judged very nearly by the height of the flame, is to be so adjusted that the meter hand shall make half a revolution in not less than four minutes.

After each testing, the flask or beaker which has received the liquid products of the combustion of 6 cubic feet of gas is to be emptied into a measuring cylinder, and then replaced to receive the washings of the condenser. Next the trumpet-tube is to be removed and well washed-out with distilled water in the measuring cylinder. The condenser is then to be flushed twice or thrice by pouring quickly into the mouth of it 40 or 50 cubic centimetres of distilled water. These washings are brought into the measuring cylinder, whose contents are to be well mixed and divided into two equal parts.

One-half of the liquid so obtained is to be set aside, in case it should be desirable to repeat the determination of the amount of sulphur which the liquid contains.

The other half[*] of the liquid is to be brought into a flask, or beaker covered with a large watch-glass, treated with hydrochloric acid sufficient in quantity to leave an excess of acid in the solution, and then raised to the boiling-point. An excess of a solution of barium chloride is now to be added, and the boiling continued for five minutes. The vessel and its contents are to be allowed to stand till the barium sulphate has settled at the bottom of the vessel, after which the clear liquid is to be as far as possible poured off through a paper filter. The remaining liquid and barium sulphate are then to be brought on to the filter, and the latter is to be well washed with hot distilled water. [In order to ascertain whether every trace of barium chloride and ammonium chloride has been removed, a small quantity of the washings from the filter should be placed in a test-tube, and a drop of a solution of silver nitrate added. Should the liquid, instead of remaining perfectly clear, become cloudy, the washing must be continued until on repeating the test no cloudiness is produced.] Dry the filter with its contents, and transfer it into a weighed platinum crucible. Heat the crucible over a burner, increasing the temperature gradually, from the point at which the paper begins to char, up to bright redness.[†] When no black particles remain, allow the crucible to cool; place it when nearly cold in a desiccator over strong sulphuric acid, and again weigh it. The difference between the first and second weighings of the crucible will give the number of grains of barium sulphate. *Multiply this number by 4·58; the result is the number of grains of sulphur in 100 cubic feet of the gas.*[‡]

This number is to be corrected for the variations of temperature and atmospheric pressure in the manner indicated under the head of "Illuminating Power," with this difference, that the mean of the first and second aerorthometer readings shall be taken as the reading.

The correction by means of the aerorthometer reading may be made most simply and with sufficient accuracy in the following manner:

When the aerorthometer reading is between	·955-·965,	·965-·975,	·975-·985,	·985-·995,
diminish the number of grains of sulphur by	4,	3,	2,	1 per cent.

When the aerorthometer reading is between ·995-1·005, no correction need be made.

When the aerorthometer reading is between	1·005-1·015,	1·015-1·025,	1·025-1·035,
increase the number of grains of sulphur by	1,	2,	3 per cent.

Example:—

Grains of barium sulphate from 3 cubic feet of gas	6·2
Grains of sulphur in 100 cubic feet of gas (uncorrected) 6·2 × 4·58 = ...	28·40
Add 28·6 × $\frac{2}{100}$ = . . .	·57
Grains of sulphur in 100 cubic feet of gas (corrected) . . .	28·97

Aerorthometer reading 1·018

Result: 29·0 *grains.*

The aerorthometer reading is the reciprocal of the tabular number. The gas examiner shall, not less often than once a month, compare the aerorthometer reading with the reciprocal of the tabular number deduced from observations of the barometer and thermometer; and if there is a difference of more than one-half per cent., the aerorthometer is to be readjusted.

Preparation of Pentane.

The pentane to be used in the 10-candle lamp should be prepared in the following manner:

Light Pennsylvanian or other petroleum similarly consisting almost wholly of the lighter hydrocarbons of the paraffin series is to be further rectified by three distillations, at 55°, 50°, and 45° C. in succession. The distillate at 45° is to be shaken up from time to time during two periods of not less than three hours each with one-tenth its bulk of (1) strong sulphuric acid, (2) solution of caustic soda. After these treatments, it is to be again distilled, and that portion is to be collected for use which comes over between the temperatures of 25° and 40°. It will consist chiefly of pentane, together with small quantities of lower and higher homologues whose presence does not affect the light of the lamp.

Gas Calorimeter.

The gas calorimeter, which has been designed by Mr. Boys, is shown in vertical section. It consists of three parts, which may be separated, or which, if in position, may be turned relatively to one another about their common axis. The parts are: (1) The base A, carrying a pair of burners B, and a regulating-tap. *The burners are made of steatite; and they are carried upon a head and tube V, also made of steatite, and circular in cross section.* The upper surface of the base is covered with a bright metal plate held in place by three centring and lifting blocks C. *The centre of this plate is perforated, and carries a ferrule W, over which is slipped a tube of fibre X, as shown. A recess 6 inches diameter and ¾-inch deep is turned out of the base, and a disc of felt Y, 5½ inches diameter and ⅜-inch thick, and perforated in the centre, is fastened centrally in the recess. Six ½-inch holes Z are drilled from the corner of the recess to the groove in the base.* The blocks are so placed as to carry (2) the vessel D, which must rest upon the horizontal portion of the blocks, and not upon their upturned ends. This vessel is provided with a central copper chimney E and a condensed water outlet F. It is jacketed with felt R, protected by a sheet of metal S. The diameter of the chimney E at the base is 3½ inches, and at the top 2½ inches, and its thickness $\frac{1}{20}$ inch. The base of the outer vessel is preferably spun in one piece with the chimney, as shown in the drawing. In order to prevent obstruction of the flow of condensed water from the outlet F by the accidental contact of the thin brass protecting wall of the pipe system, a small dimple is punched in the outer casing on either side of the outlet F, so as to project inwardly about $\frac{1}{16}$ inch. Resting on the rim of the vessel D are (3) the water circulating system of the calorimeter attached to the lid G. Beginning at the centre where the outflow is situated, there is a brass box H, which acts as a temperature equalizing chamber for the outlet water. Two dished plates of thin brass K K are held in place by three scrolls of thin brass L L L. These are simply strips bent round like unwound clock springs, so as to guide the water in a spiral direction inwards, then outwards, and then inwards again to the outlet. The lower or pendant portion of the box is kept cool by circulating water, the channel for which may be made in the solid metal, as shown on the right side, or by sweating on a tube, as shown on the left. Connected to the water-channel at the lowest point by a union are five or six turns of copper pipe, such as is used in a motor-car radiator of the kind known as Clarkson's. In this a helix of copper wire threaded with copper wire is wound round the tube, and the whole is sweated together by emersion in a bath of melted solder. A second coil of pipe of similar construction surrounding the first is fastened to it at the lower end by a union. This terminates at the upper end in a block, to which the inlet-water box and the thermometer holder are secured by a union, as shown at O. An outlet-water box P and the thermometer holder are similarly secured above the equalizing chamber H. The lowest turns of the two coils M N are immersed in the water, which in the first instance is put in the vessel D.

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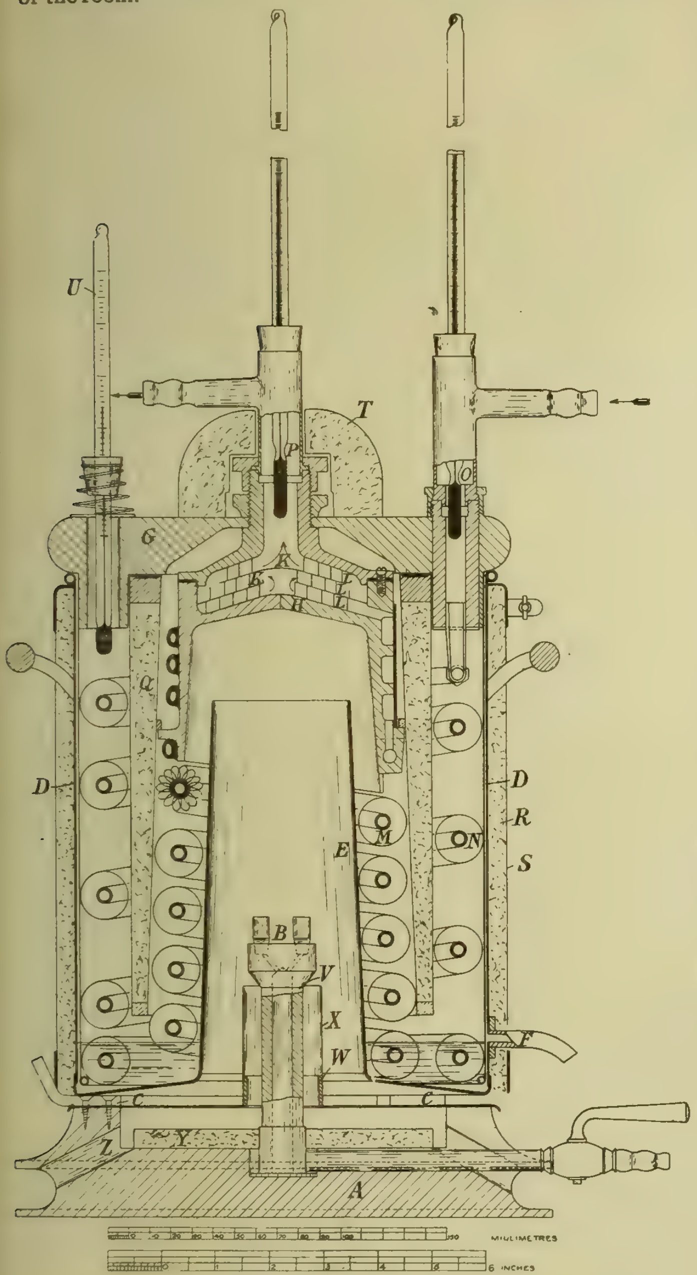
[*] *If preferred a smaller proportion, say $\frac{1}{n}$th part of the liquid may be taken for the determination, in which case the number of grains of barium sulphate obtained must be multiplied by 2·29n, instead of being multiplied by 4·58.*

[†] An equally good and more expeditious method is to drop the filter with its contents, drained but not dried, into the red-hot crucible.

[‡] 233·5 *grains of barium sulphate are formed from* 32·1 *grains of sulphur; w grains of barium sulphate have been obtained from* 5 *cubic feet of gas. Hence in* 100 *cubic feet of gas there are* $\frac{32·1}{233·5} \times \frac{100}{3} = 4·58\,w$ *grains of sulphur.*

Between the outer and inner coils M N is placed a brattice Q made of thin sheet brass, containing cork-dust to act as a heat insulator. The upper annular space in the brattice is closed by a wooden ring, and that end is immersed in melted rosin and beeswax cement, to protect it from any moisture which might condense upon it. The brattice is carried by an internal flange which rests upon the lower edge of the casting H. A cylindrical wall of thin sheet brass, a very little smaller than the vessel D, is secured to the lid, so that when the instrument is lifted out of the vessel and placed upon the table, the coils are protected from injury. The narrow air-space between this and the vessel D also serves to prevent interchange of heat between the calorimeter and the air of the room.



Tho Boys Calorimeter.

The two thermometers for reading the water temperatures and a third (U) for reading the temperature of the effluent gases are all near together and at the same level. *The thermometer U for finding the temperature of the effluent gases is divided on the Fahrenheit scale.* It is supported (as shown) by means of a cork and an open spiral of wires, so that the bulb is a short way above the circulating coil, and with its stem passing through one of the five holes provided for the effluent gases. The lid may be turned round into any position relatively to the gas-inlet and condensed water drip that may be convenient for observation, and the inlet and outlet water boxes may themselves be turned so that their branch tubes point in any direction. A wood shield T, made in two halves, serves to protect the outlet-water box from loss of heat.

A regular supply of water is maintained by connecting one of the two outer pipes of the overflow funnel to a small tap over the sink. The overflow funnel is fastened to the wall about 1 metre above the sink; and the other outer pipe is connected to a tube in which there is a diaphragm with a hole about 2·3 mm. in diameter. The tube is connected to the inlet-pipe of the calorimeter. A piece of stiff rubber pipe, long enough to carry the outflow water clear of the calorimeter is slipped on to the outflow branch, and the water is turned on so that a little escapes by the middle pipe of the overflow funnel, and is led by a third piece of tube into the sink. The amount of water that passes through the calorimeter in four minutes should be sufficient to fill the graduated vessel to some point above the lowest division, but insufficient in five minutes to come above the highest division. If this is not found to be the case, a moderate lowering of the overflow funnel or reaming-out of the hole in the diaphragm will make it so. The overflow funnel should be provided with a lid to keep out dust. The graduated vessel shall have been previously examined and certified by the Gas Referees.

The thermometers for reading the temperature of the inlet and outlet water should be divided on the Centigrade scale into tenths of a degree; and they should be provided with reading lenses and pointers that will slide upon them. The thermometers are held in place by corks (not india-rubber), making an air-tight fit within the inlet and outlet water boxes. Care must be taken that the bulbs are fully immersed, as shown. The positions of these thermometers should be interchanged every month, and also before the second testing when a second testing is made on any day in accordance with section 4 (1) (*b*) of the Gas Light and Coke Company's Act, 1914. The thermometers for the hygrometer and for reading the temperature of the effluent gases should be divided on the Fahrenheit scale into degrees. The thermometers used in the testings must bear a distinctive number, which will be recorded on a certificate of correctness issued by the Gas Referees; and no thermometer shall be used in the testings which has not been certified by them.

The flow of air to the burners is determined by the degree to which the passage is restricted at the inlet and at the outlet *and at the base of the brattice.* The blocks C which determine the restriction at the inlet are made of metal $\frac{3}{16}$ inch or about 5 millimetres thick; while the holes round the lid which determine the restriction at the outlet are five in number, and are $\frac{5}{8}$ inch or 16 millimetres in diameter.

The calorimeter should stand on a table by the side of a sink, so that the condensed water and hot water outlets overhang and deliver into the sink. A suitable change-over funnel is shown [in the "Notification"]. A piece of india-rubber tube reaching nearly to the base should be attached to the waste-water pipe so as to avoid splashing,* and another piece may conveniently be slipped on to the condensed water outlet so as to lead the condensed water into a flask; but care should be taken that the small side hole is not covered by the tube. *A vessel* must be provided of the size of the vessel D containing water in which is dissolved sufficient carbonate of soda to make it definitely alkaline. The calorimeter after use is to be lifted out of its vessel D and placed in the alkaline solution, and there left until it is again required for use. The liquid should not, when the calorimeter is placed in it, come within 2 inches of the top of the vessel. The liquid must be replenished from time to time, and its alkalinity maintained.

The ventilated wet and dry bulb hygrometer is also shown [in the "Notification"]. The main ventilating system consists of a single piece of glass of the shape and dimensions shown in the figure. This stands upon a metal base which, by means of a glass tube, carries a single rat-tail burner adapted to make a flame about 1½ inches high. The air to supply the burner and chimney is drawn in through the two holes opposite the thermometer bulbs, one of which is covered with cotton and connected by means of wick with the water in the cup immediately below. The glass tube fits easily over the stem of the metal base, which is covered with cloth or other soft material to prevent injury to the glass. The upper or chimney part of the *wide tube* may be made of metal fitting over a shorter glass tube; but the flame should in no case be obscured from view. The thermometers are divided into degrees on the Fahrenheit scale. Distilled water is to be used in the cup under the wet bulb.

Calorific Value of Gas.

In a form with example of calculation of the calorific value of gas, the line appears: "Time of four revolutions of meter hand, 4 min. 54 sec. [instead of 4 min. 24 sec., as before].

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* As damage to the outlet thermometer or the calorimeter has in some cases been caused by the turning off of the water supply, it may be well to suggest a method of meeting this difficulty. The waste water from the change-over funnel may be led into a small vessel from the bottom of which the water can escape, but at a rate less than that of supply. This vessel may be counterbalanced by a weight or spring so that when empty it rises a small distance and acting as a trigger allows a weight to fall or a wound-up alarum to ring, thus attracting the attention of the gas examiner.

An Enemy Trading Committee.—The Board of Trade have appointed Mr. Ernest R. Moon, C.B., K.C. (Chairman), the Hon. John D. FitzGerald, K.C., Sir George Croydon Marks, M.P., and Mr. Gershom Stewart, M.P., to be a Committee to advise them on matters arising under the Trading with the Enemy Amendment Act, 1916. The Committee Secretary is Mr. W. P. Bowyer.

"Bacterized Peat."—The Manchester City Council have accepted a proposal made by the Cleansing Committee to undertake an experiment in the manufacture of "bacterized peat" or "humogen," in accordance with a plan drawn up by Professor Bottomley. A sum of £400 or £500 will, it is anticipated, meet the cost of the experiments; and as the Committee possess 130 acres of raw peat, the material necessary is at hand. It is hoped that, when treated, the Corporation will be able to sell the peat at a good profit. Professor Bottomley has declared he has no intention of exploiting his discovery at the expense of the nation.

PROCESS FOR TREATING AMMONIACAL LIQUOR.

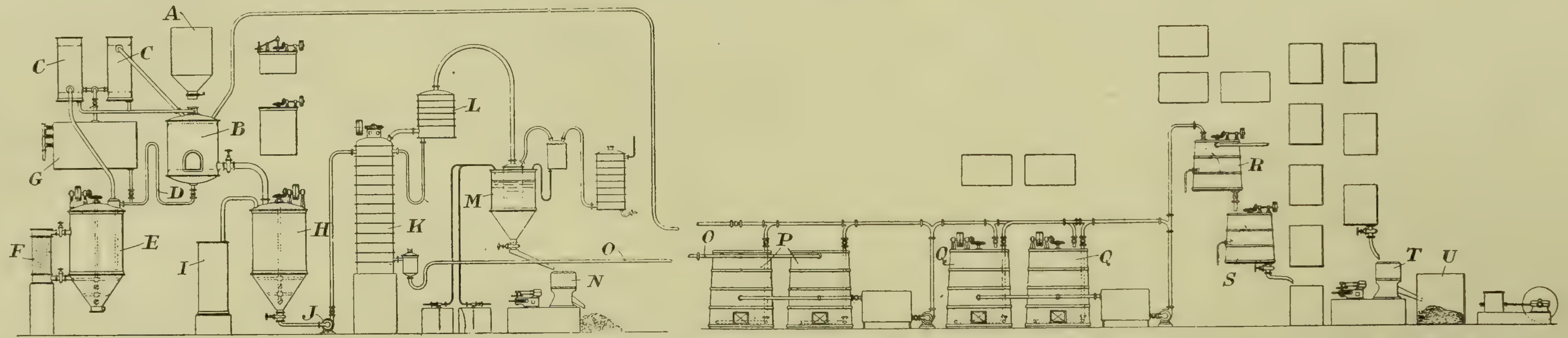
A French Patent.

A method has recently been patented in France for the extraction of ammonia, sulphur, and prussian blue from gas liquor according to which the inventors, MM. Bonneau and Hasenfratz, first evaporate the liquor, and then extract the sulphur from the residual mass. The residue from the latter process, together with the distillate from the first operation, is next treated with lime for the removal of the ammonia, and the portion then left is further treated with chloride of potassium for conversion of the cyanide compounds into double ferrocyanide of calcium and potassium, which latter is first decomposed by carbonate of soda and then converted into prussian blue with an iron salt. The "Journal des Usines à Gaz," in publishing the following description of the plant in its Jan. 20 issue, is careful to point out that it is without information allowing it to confirm the epithet "perfect" employed with regard to the process in the patent specification.

The crude liquor is first evaporated in a steam-jacketed cylindrical chamber, from which the water and free ammonia are drawn off and condensed in a coil. The desiccated mass is treated in a diffuser-extractor with trichlorethylene at a raised temperature, yielding a warm saturated solution of sulphur. On cooling, a large part of the sulphur separates out, while the cold solution can be distilled and the condensed solvent used for a fresh operation. In the drawing, the hopper for the dried mass is shown at A; and B is the diffuser-extractor to which the heated solvent is supplied from the condensers C. The saturated fluid passes by the syphon D to the reservoir E, where it is distilled off by steam heat from F and condensed at C—this cycle of operations proceeding continuously. When the whole of the sulphur has been extracted, the passage of the condensed distillate from C is diverted to G, and a fresh lot of residue treated by first running off the exhausted material as a sludge (by admixture with water) into the receptacle H, where it is mixed by means of revolving paddles, and any solvent distilled off by direct steam into a condenser I. Milk of lime is then admitted into H, and the mixture heated to boiling. This distills off part of the ammonia, and converts the iron ferrocyanide compounds into soluble calcium ferrocyanide. The boiling mixture is forced by the pump J to the distillation column K, where the remainder of the ammonia is discharged from the liquor. It traverses the check column L and passes into the sulphuric acid vat M, whence it is discharged to the hydro-extractor N, and is finally collected for delivery.

The exhausted liquor from K, containing the ferrocyanide in solution, is run off by the pipe O to a couple of tanks P, in which it is allowed to settle. Thence it is pumped into a similar pair of tanks Q, provided with mixing paddles and steam-heated, and is here treated at a boiling heat with chloride of potassium, yielding the insoluble double ferrocyanide of calcium and potassium. This settles out, the clear liquor is run off, and the precipitate treated with soda carbonate, which throws down a sludge of carbonate of lime and leaves a liquor of soluble ferrocyanides.

The last stage is to pump this liquor from the second pair of tanks to one R, in which addition is made first of sulphuric acid, until the mixture is acid, and then of sulphate of iron dissolved in boiling water. The white ferrous ferrocyanide thus formed flows by gravity to a further tank S, in which its conversion into prussian blue is carried out with soda hypochlorite. The final product is washed several times by decantation, dried on a hydro-extractor T, and eventually *in vacuo* in the tank U.



THE ORIGIN OF COAL.

A review of investigations and theories on the origin of coal has been given by Rosenthal in recent numbers of "Braunkohle." A summary of his communication appeared in the "Journal für Gasbeleuchtung for the 5th inst.

As early as 1778 Beroldingen pointed out that a relationship subsisted between peat, lignite, and coal, and that lignite might be produced from peat, and coal from lignite. Peat, he considered, might be formed by the submersion of vegetation. Potonié drew a distinction between combustible and incombustible mineral matter and subdivided the former, which he termed caustobiolith, into three groups—viz., sapropelite, mineral humus, and liptobiolith. It followed from his classification that a coal could never be formed from the tertiary lignite which would be exactly the same as the carboniferous pit coal. Chemically, according to Liebig, coal is formed slowly from vegetable matter, either in the moist state with unchecked access of air, or with exclusion of air, or in contact under water with decaying organic matter. The distinctions indicated are, however, not recognized at present.

The external conditions which lead to the formation of coal are: Temperature, pressure, and lapse of time. The greater the lapse of time and the greater the pressure the higher is the content of carbon in the coal. In attempting to imitate the process of coal formation in the laboratory, it has commonly been overlooked that the decomposition of cellulose is an exothermic process, and that the considerable rise of temperature which thereby results generally causes a partial carbonization of the coal formed. Bergius, in his investigations, controlled the temperature by using liquid water in conditions analogous to the natural ones, and at the same time attained a sufficient velocity of the reaction. The coal which he produced from peat and cellulose corresponded closely in composition with natural bituminous coal, but showed certain differences in its external characteristics. By increasing the pressure, however, it was found possible to produce coal which externally resembled natural pit coal.

Condensed carbonic acid has been found in Lower Silesian coal pits. The chemical composition of the gases enclosed in Lower Silesian coal has been stated by J. Meyer, who has observed that the coal of the seams from which carbonic acid is evolved has an anthracitic character. The carbonic acid in the Silesian pits actually occurs in three conditions—viz.: (1) It is evolved from subterranean wells saturated with it; (2) it is enclosed in the compressed state in pockets in the coal itself; and (3) the coal contains absorbed carbonic acid which escapes when the coal is broken up. Meyer considers that the carbonic acid may result from the coal formation process, especially as Bergius observed its occurrence in his experiments on the decomposition of cellulose. But carbonic acid may also be produced by the action of superheated liquid water on coal which is already formed. Such conditions would occur when hot mineral matter was brought by eruption into intimate contact with wet coal.

SIXTY YEARS AGO.

From the "Journal" for Feb. 19, 1856.

A Provident Institution for Gas Engineers.—A valued correspondent suggested in our last number that it would be desirable to establish an institution for the purpose of relieving the distress of decayed members of the profession. Unfortunately, the number of instances which have come under our notice of the necessity for some such institution is so great that we feel it our duty to call the serious attention of our colleagues to the question. There are benefit societies among those whom it is the fashion to call the working classes, not only of engineers, but of almost every other trade. Travellers, licensed victuallers, artists, literary men, and actors have very wisely and very charitably combined together to relieve the wants of those of their numbers whom age, or suffering, or "the thousand ills that flesh is heir to," have deprived of the means of supporting themselves. It is strange that engineers should not, in their turn, have felt it necessary to adopt some such measure long ere now, especially as the nature of the pursuit is one which is not only dangerous from its exposure to accident, but also on account of the fearful manner in which it taxes the mental and physical powers of its followers. We can assure our readers that we shall be anxious to co-operate in any attempt to remove what we consider to be somewhat of the nature of a reproach to our profession; and we earnestly invite suggestions upon the subject. Very recently it has been necessary to make an appeal (in favour of a worthy but reduced engineer) which has been nobly responded to; but it must evidently be preferable to found some permanent institution than to be thus compelled to depend on the casual beneficence of men often hard pressed themselves to maintain their own positions in society—particularly in these days of small salaries for professional men.

Corporations as Trustees.—We are happy to observe that the general body of the Liverpool Town Council have arrived at fairer conclusions with respect to the controversy lately raised between the Sub-Committee and the Gas Company of their town, than the members of the same Committee appear to have done. By a very considerable majority, the extravagantly absurd scheme of confiscating the property of the Company was rejected; and the Town Council have contented themselves with calling for the nomination of an inspector of meters, and giving instructions to the borough engineer to attend to the testing of the gas. This was as it ought to have been done; and the most prominent leaders of the movement by which the proceedings of the Gas Committee were set aside adopted the style of argument we have always adopted upon this subject. Corporations never can manufacture as cheaply as individuals directly interested in the economical results of the operations required; and Mr. Holme was perfectly justified in saying that, if the Liverpool Corporation took the manufacture of gas into their own hands, the price of that article would probably not be diminished. That gentleman also advanced a principle which we believe to be essentially true —"that corporations had no right to be traders; they were trustees;" and we have had too many occasions of late to protest against the tendency of the municipalities, especially in the North of England, to overlook this very important, and almost self-evident, truth in political economy. At present the Town Council of Liverpool do not seem likely to be easily induced to imitate the errors of their neighbours.

A Rotary Gas-Making Machine.

In an issue of the Nanaimo (Vancouver Island) "Free Press" published early last month, there appeared a long and graphic article, the writer of which essays to show how a "Local Invention Puts the Island on a Natural Gas Basis." The picture that is drawn of what a natural gas basis means is an alluring one indeed; and an invention that succeeded in bringing about the realizatien of this golden dream would more than deserve all the good things that could be said of it. We learn that it is to be brought about by a new rotary gas-making machine, the invention of Mr. Walter Thomas, which is intended to utilize the vast quantities of mine refuse which exist within a few miles of the radius of Nanaimo. Being gas fired, it does away with the necessity for coke for heating; and it is claimed that "its rotary motion constantly altering the relation of the particles of coal to the hot retort and to each other, distils the gases in such a diabolically short space of time that the thing seems uncanny." Having, too, an automatic feed and discharging itself, "cuts the labour bill to such an extent that the labour cost of about 20 c. per 1000 cubic feet in the ordinary gas-works would be cut to about 3 c. with the rotary gas-making machine. The rotary motion of the retort, together with the fact that it "is heated by the cheap gas made from the refuse from the gas making or direct from low-grade fuel by a well-known method (a different operation from the old-fashioned gas-producer), makes the rotary gas-making machine," it is claimed, "the one machine in the world to handle the immense quantities of low-grade fuel" which surround Nanaimo, Vancouver Island. May the invention achieve all the success thus anticipated! The proposal brings back to mind the Yeadon and Adgie revolving retort which was experimented with in this country twenty and more years ago.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

A Meeting of the Association was held in the Royal Technical College, Glasgow, on Saturday last—Mr. David Fulton (the President) in the chair.

At the outset, the interim Hon. Secretary (Mr. Malcolm Littlejohn) intimated that Mr. Fulton had been awarded the medal for the best paper read last session. It had been decided to advance the date of the general meeting to April 1.

Two papers were read at the meeting—one on "Coke Handling and Carbonization," by Mr. C. Dickson, of Kirkintilloch; the other, "Notes on Purification," by Mr. W. Bennett, of Greenock. These will be found on pp. 417 and 419. Discussion was limited to Mr. Dickson's paper; it being agreed, on the suggestion of Mr. G. T. Purves, that it would be advisable to postpone the discussion on that by Mr. Bennett until the paper had been further studied. Mr. Bennett's contribution will therefore be discussed on the occasion of the visit of the Association to the Kilmarnock Gas-Works on the 18th prox.

PROFESSOR H. E. ARMSTRONG ON THE COAL PROBLEM.

Addressing the members of the Newcastle Section of the Society of Chemical Industry, at a meeting held in the lecture theatre of the North of England Mining Institute at Newcastle last Wednesday, Professor Henry E. Armstrong, F.R.S., dealt with the subject of "The Problems of Coal, with Reference to the Complete and Provident Utilization of the Supplies and of Fuels Generally: Preliminary Discussion and Scheme." Mr. Charles Carpenter, D.Sc., the Chairman of the South Metropolitan Gas Company, who is President of the Society, was in the chair.

Squandering Natural Resources.

Professor Armstrong stated that everyone was aware that we wasted coal profusely and that it was fast going up in price. As we now burnt approximately 200 million tons per annum, it was unnecessary to dwell upon the fact that, if we could double the efficiency of our methods of using fuel, we should be able to keep much money in our purse. There was a spirit of altruism growing up gradually which was leading us to think that we must take effective steps to check the thoughtless squandering of natural resources which had been a dominant characteristic of civilization of late years—not of fuel alone, but of raw materials generally. The primary political issue in connection with coal to be considered some day in the not distant future would be as to the ownership of our national fuel supplies. We should be prepared to deal with this grave problem in an absolutely philosophic and scientific manner, without tinge of political feeling. The question of exporting coal should receive more immediate attention.

Present methods of coal getting were far from being perfect, and much was left underground that would never be recovered. Should not the delivery of all coal at the surface, not merely of that which is easily won, be made obligatory? At least, it would seem to be desirable in such an industry to pool intelligence and work all mines efficiently. Under a system of uncontrolled private ownership, this was not likely to happen. Methods of cleaning coal satisfactorily should be developed. Apparently, there was much to be done in this direction, especially in the case of the poorer fuels. The utilization of minerals associated with coal would need consideration. In view of the growing demand for sulphur, it might be desirable, in certain cases, even to separate pyrites—a far less difficult task than formerly, in view of the introduction of effective methods of concentrating heavy minerals—by levigation in water, with the aid of oily substances, such as were used at the Broken Hill mines and elsewhere in dealing with zinc and other ores. The question of the ventilation of mines played an all-important part, both as affecting the health of the miners, the depth to which the workings could be carried, and the prevention of explosions. The measures taken hitherto had been little short of perfunctory; and a far more representative body of workers should be engaged without delay to prosecute inquiry. The question of the constant control, by chemical means especially, of the state of ventilation in mines called for immediate attention. He was informed that enough was known to make such control really effective, if properly conducted by persons who understood the work.

Bye-Products Recovery.

In burning coal in the ordinary way, either in raising power or for domestic purposes, not only was an unsatisfactory modicum of the heat energy utilized, but everything else was sacrificed. Little short of 20 million tons of coal were carbonized annually by the gas industry, and at least an equal quantity was coked for the iron and steel industry. The volatile products had long been saved by the gas industry; but it was only quite recently that any considerable development of bye-product recovery coking plant had been effected. Now, however, fully two-thirds of the coal used in making blast-furnace coke was produced in recovery ovens of various types; and it was to be expected that the beehive oven would soon pass into oblivion—if not spontaneously, by public enactment. It was essential to recognize that coal now counted not only as a fuel but in sundry other ways—in agriculture, on account of the ammonia; in gold mining, as not a little cyanide was prepared from gas liquors; in the dye-stuff industry; as a source of sulphur; and as affording liquid fuel for internal combustion engines. At the moment, most of the material used formerly in the dye-stuff industry was being diverted to the manufacture of explosives; in addition, for the same purpose, coal gas was being stripped of vaporous constituents from which much of its value was derived.

At most, about 20 per cent. of the coal we consumed was so used that the volatile products were recovered. Ammonia made in Germany in factories by the direct interaction of nitrogen and hydrogen, was fast coming into competition with the natural product; and it might well happen that the victory gained over Nature in the case of madder-red and indigo-blue would be repeated in the case of ammonia. It seemed little short of criminal that we should be talking of making ammonia and nitric acid by synthetic methods. The same argument might be applied to the sulphur in coal—at least 400,000 tons of which were not only wasted but forced into the atmosphere to pollute it.

Domestic Users and "Raw" Coal.

The question he desired to raise was whether drastic action should not be taken to put an end to much of the waste involved in burning raw coal—at all events, in the case of that consumed by domestic users. He urged the Society to advocate an enactment forbidding the use of raw coal for domestic purposes, such enactment to come into force at latest about ten years hence. He did not believe that hard coke such as was now produced could ever be a satisfactory domestic fuel. A softer form—of the Coalite type—seemed to be required. Such a conclusion, if accepted, would have most important consequences. It would involve the complete reconstruction of the gas industry, as that industry would have cast upon it the double function of providing a suitable solid fuel as well as a suitable gaseous fuel. The whole question of power centres, possibly of heat-distributing centres also, must be taken into consideration.

Advice to the Gas Industry.

The gas industry was rapidly approaching a second period of crisis. The battle between electric and gas light must soon be fought to a finish. The advantage the electric light had over gas light for domestic use was unquestionable; and the former must prevail in the end. Might it not be to the advantage of the gas industry that this should be recognized at an early date, and the mains set free for the supply of heating and power gas? The rare materials used in making Auer mantles would not always be forthcoming. Unless certain changes in gas were made at an early date, users would be driven into the arms of the purveyor of electric light. Gas must be both cheapened in price and improved in quality. The price, except in towns such as Sheffield and Widnes, was altogether disproportionate to value. This was because the capital locked up in the industry was excessive. The industry must be conducted to afford larger profits, comparable with those made in the other chemical industries—for it was a chemical industry, though hitherto it had been all but entirely in the hands of men who knew not chemistry.

A disastrous step was taken by gas managers a few years ago when they secured the repeal of the sulphur clauses. Since then, our homes had been flooded with sulphurous fumes, and we had suffered not a little in consequence, though most users of gas were too ignorant to appreciate the effects, and many gas engineers probably were not alive to the nature of the policy that they had accepted. Nothing, to his mind, had been more satisfactory, in late years, than the action that was taken by the technical staff of the South Metropolitan Gas Company, in recognizing the moral obligation that was cast upon the industry when thus granted free trade in sulphur. The patience and ability displayed by an unassuming trinity at Greenwich in developing a successful process of removing all but traces of sulphur compounds from gas was worthy to rank with the best German chemical work. Seven years were spent in working out the process and in carrying it into practice on a large scale. The inquiry was promoted by their President (Mr. Charles Carpenter); but he had assigned the credit for the chemical and physical foundation of the process to the Chief Chemist of the Company (Mr. Evans), who, with Mr. Franks, one of the younger engineers, was also mainly responsible for translating the process to the large-scale plants. The invention and elaboration of such a process in their gas-works marked the opening of a new era—that of science—in the industry. Science had in the past been strangely neglected by gas engineers and boards of directors throughout the country. In view of the many problems awaiting solution, which must be solved at no distant date, it was hoped that the example set by the South Metropolitan Gas Company in maintaining a highly competent scientific staff would not be lost on the country.

Now that an efficient process was available, the force of public opinion should compel all gas companies once more to concern themselves with the removal of sulphur. It was the policy of gas managers in the past to encourage the waste of gas and to pay little attention to quality beyond that required to satisfy statutory obligations. A few enlightened undertakings now saw the folly of such a policy; and it must be expected that, when they were once more free to attend properly to public interests, they would seek to supply an article of standard quality calculated to satisfy requirements, and thus set an example which must be followed. In no other way would the gas industry be likely to maintain its position.

Scientific Inquiry into the Fuel Problem.

As to the production of the solid fuel suitable for general use, and a sufficiency of gaseous fuel, the lecturer's proposal involved a thorough experimental inquiry to determine the conditions best suited to produce coke that would give satisfaction in practice, in the first place, to domestic users, though he contemplated the extension of the practice to all bituminous coals. The inquiry would be too costly, extensive, and problematic to be carried out privately, nor should it be done at the expense of the country at large. Therefore, he suggested that the Society, which was not only a body of coal users but the only body that could understand all the problems involved in the use of fuels, should memorialize the Government to place a tax upon all the coal raised, and that the funds so obtained should be expended, under the competent direction of persons appointed by the Society, in developing suitable methods so as to conserve, as far as possible, all valuable educts, and, at the same time, produce solid and gaseous fuels that were suited to public use. The inquiry should be extended in every necessary direction, and should involve also the discussion of all questions of policy relating to coal and its uses—in other words, the study of fuel problems in general. The services must be enlisted of all the men in the country who were really competent to take actual part in, and have responsible charge of and direct, such an inquiry; and they must be properly paid for their services.

It was essential that action should be taken at an early date in direct protection of public interests—as it was not unlikely that money would ere long be asked for for soft-coke undertakings. It was the duty of the Society to come forward in protection of the public against the company promoter in this particular instance. In self-protection, scientific workers must, in future, intervene to prevent the public being misled by interested expert opinion. It might be argued that such action would tend to prevent the flow of capital; it was, however, certain to check evaporation of capital.

Professor Armstrong then dealt with the attempts made hitherto to produce soft coke and to utilize the bye-products properly, and said these had not always been in competent hands. It was most unfortunate that proper advantage had never been taken of the opportunities afforded by the various vain attempts made of late years to develop low-temperature coking as a commercial enterprise. He was satisfied that the attempts had never been made under proper conditions. He quoted, as "the one luminous contribution to the subject," that made by Dr. Beilby to the British Association meeting in Birmingham in 1913.*

One inquiry of special importance would involve a complete geological and chemical survey of our coals, to determine as far as possible their composition and the distribution and extent of the different varieties. It might be desirable to set aside some varieties and confine their use to certain special purposes—the Durham coal, for example, as a coking coal. An inquiry into the use of fuels must also be carried out. The waste, due to ignorance on the part of users, was enormous. The provision of efficient heating appliances, whether for gaseous, liquid, or solid fuel, should be made the subject of profound study. The economical use of fuels in our industries should be discussed. Not only was it necessary to discuss the various appliances—like water softeners, heat economizers, mechanical stoking machinery, boilers, &c.—but also broader questions—*e.g.*, the distribution of the load factor in works, not omitting that of co-operative systems of producing power. Full discussions of gas-producers and their efficiency, as well as of the methods of using liquid fuel, were of immediate importance. In fact, no question bearing on the production and provident use of fuels must be left out of consideration.

Work for a National Fuel Board.

It would probably be necessary to establish a Central National Fuel Board and Secondary Boards to control certain specified areas. Coal would no longer be used as such, but would be delivered at selected centres and there prepared to serve as fuel—everything being separated from it that could be put to higher use. The gas produced in the coking process would be raised to the necessary volume by dilution with producer gas and supplied separately. The gas-works as we now knew them should disappear, and their place be taken by the fuel and power works. Great engineering problems would arise under such a scheme, including the distribution of gas, probably under pressure, over long distances. The industry at large and the use of fuel should be brought absolutely under scientific control. To this end, it would be necessary to establish one or more central laboratories at which the major problems could be studied.

Probably, in the near future, the coking industry, as well as the gas industry, would be closely linked with manufacturing industries, especially with that of organic chemicals, including dye-stuffs. It would probably be desirable at some works to produce intermediate products from the raw materials separated during the coking process, as the sole value of these raw materials, when very large quantities were produced, might in some cases be so low that a remunerative return would not be obtainable in any other way. It appeared already desirable that those who had bye-product recovery coking plants should co-operate from this point of view, and, without further delay, should establish a central research department to serve the special purposes of the industry. He commended his proposals to the careful consideration of all sections of the Society, asking not only for immediate consideration but for little short of instant action.

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* See "Journal," Vol. CXXIII, p. 838.

DISCUSSION.

The President said that they were having the severest lesson possible that the individualism to which they had been so accustomed, and upon which they had so largely prided themselves, had proved an insecure reed. The question raised by Professor Armstrong was how far, in what direction, and by what steps, organization could be applied to the coal industry. He was sure that, in such a meeting, formed of so many experts in various branches of the coal industry, help would be given in devising means to deal with a problem concerning which there was no possible doubt that serious action would have to be taken.

Dr. Dunn, the City Analyst for Newcastle, said he had had the opportunity of examining a good many of the low-temperature processes for the distillation of coal, and had found the state of things to which Professor Armstrong had so luminously drawn attention. He thought that there was an enormous future for a smokeless fuel, of the nature of coalite—using the term "coalite" to signify the coke produced from any system of low-temperature distillation. There was an enormous field for such coke as domestic fuel. In one small experimental works in London, where smokeless fuel was being produced, the whole of the output was taken by coal merchants, who were, indeed, prepared to take any additional quantity the works could produce. This smokeless fuel was being paid for by consumers at a rate considerably in advance of the price in London of good household coal. With a view to testing the suitability of such product for domestic fires, he recently had a ton of it sent from London to his own house. They all knew how conservative the domestic servant was; but, after a month's use of the ton of soft coke, his cook was disconsolate at not being able to procure any more. It entailed less labour, there was no cleaning of flues necessary, and it was more under control and better in every way than coal. The difficulty in regard to these processes was that most of them had been carried out by people with very little capital and technical knowledge. He had come across four or five such processes, each exhibiting some point of advantage. If instead of this individual experimentation by people ignorant of one another's work, there were some central body to which people could apply and bring their devices, he had no doubt very valuable results would be obtained.

Mr. W. Diamond, the Manager of the coke-ovens at Messrs. John Bowes and Partners' Marley Hill Colliery, stated that the chief effort in the coke industry was to produce coke of good metallurgical quality. When patent ovens first came out, the furnace people greatly objected to the soft, dark, and dirty coke produced; but they were coming round, and showed great appreciation of these bye-product ovens. So far as coke produced by low-temperature distillation was concerned, when the first ovens were started there were no great heats. If they got anything like 900°, taking 50 to 55 hours carbonizing, it certainly produced a very dense coke, and also a more fluid tar than at present. But while they now obtained higher temperatures in the more recent ovens, they also got a very thick tar, full of naphthalene and pitch. In the old days, they used to get a very nice, fine, thin tar, and obtained very good benzene, phenols, &c., out of it. If they had low-temperature carbonizing again, they should get that better quality of tar—probably not so much ammonia, but they would again have a greater outlet for the fuel. If individual effort could be collected and put into a Board of Control, the results might be very valuable.

Mr. Thomas Hardie, the Engineer of the Newcastle and Gateshead Gas Company, said that, while it was true that the low-temperature process of coal carbonization might have a future, it certainly had also had a past; and that past had not shown that carbonization could be made a commercial success, even if it could be proved by scientific research that, by carbonizing coal in this way, it might be possible to produce from the bodies which it contained the greatest efficiency. To make any process a success at the present day, it must be commercially as well as technically and scientifically successful. So far as gas for fuel was concerned, he had not learned that it should be further purified from sulphur than at present. The movement which took place a few years ago was not, as might be supposed, a distinct departure from the practice of a great number of years. The restrictions were removed in a certain number of cases; but, as a matter of fact, the larger number of undertakings in this country had not been under any restrictions whatever, and it was perfectly well known what the conditions would be when the restrictions were removed from the others. If methods could be discovered whereby the fuel supplies could be controlled and coal used more economically it should be done, and if it resulted in disadvantage to the gas industry, that industry would have to stand it. He did not think that gas undertakings would be behind in altering their plants to meet any new successful system.

Dr. Paterson, the Chief Chemist to Messrs. Swan, Hunter, and Wigham Richardson, Limited, of Wallsend, was of the opinion that, for household heating purposes, coal gas was very hard to beat. If a solid fuel was required, his experience was that one could take any type of coke refuse and add to it small proportions of the liquid substances obtained during distillation and make a perfectly satisfactory household fuel which was quite smokeless. As to the ownership of gas-works and coke-ovens, there was, probably, a great deal to be said for the nationalization of these industries; but there were difficulties in the way of nationalization of chemical and material knowledge which might almost be insuperable. One might not get the very best type of chemist or coal user to give his views. The best spur to action was the incentive to make money out of it; and if they took away this incentive, they took away the spur to usefulness.

Professor P. Phillips Bedson, of the Chair of Chemistry, Armstrong College, Newcastle, said that, in connection with the suggestion that coal should be taxed to provide money for research, this was already done in Westphalia. Gas there was used as a fuel for the production of steam, which was used for the generation of electricity, which, produced at different collieries, was pooled and distributed over the district. There was waste heat at Middlesbrough from many of the coke-oven and bye-product plants, which might be used to produce electricity, which itself might be pooled for the benefit of the district.

Mr. Gerald Stoney drew the speaker's attention to the coke-ovens of the Priestman Collieries, Limited, where the gas was run under boilers, and the power thus produced put into the general system of the Electric Supply Company, and also to other collieries where a similar thing was done.

Professor Bedson retorted that he was quite familiar with the facts mentioned; but his point was that the community did not benefit.

A Speaker mentioned that the mixing of coke-oven gas and coal gas had been successful, from both scientific and commercial points of view, at Middlesbrough and at Leeds.

The President did not think that Sir George Livesey had any rooted objection to purifying from sulphur compounds other than the general dislike of being worried by chemists. He was fully alive to the disadvantages of the sulphur; and he (the speaker) remembered being told by him about a shelf in his house—the house was adjacent to the works—where the books went rotten because of the sulphur compounds found near the ceiling. Sir George spent a good deal of time and money in endeavouring to elucidate the problem, but eventually gave it up. Of late years, the great anxiety of large buyers of coal, certainly in the South, had not been to get coal which would pass the proper physical and chemical tests, but to get supplies at all.

Professor Armstrong, replying to the discussion, said that his mind was entirely open as to the character of the fuel ultimately required. What he wanted was a full and complete inquiry into the whole question. Most severe remarks were made in financial circles against them and their profession because they did not come forward for the protection of the public; and the Society must do something if it was to be of any use at all.

Output of Coal in Germany.

The effect of the continuance of war conditions on the output of coal in Germany is shown by the statistics of the production for last year. The figures are given side by side with those for 1914 (which was also largely affected by the war conditions) and 1913. The figures represent thousands of metric tons.

	1915.	1914.	1913.
Coal	146,712	161,535	191,500
Brown coal or lignite	88,370	83,947	87,100
Coke	26,359	27,325	32,100
Coal briquettes	6,392	5,949	5,800
Lignite briquettes	23,350	21,449	21,417

The production of brown coal or lignite has not suffered appreciably from the war conditions. The explanation offered is that, for industrial furnaces, brown coal briquettes are constantly growing in favour.

Structure of Coal-Measures Plants.

At the Royal Photographic Society last Tuesday, Dr. George H. Rodman, of Richmond, delivered a popular lecture on the manufacture of coal gas, illustrated by some fifty photographic lantern slides, showing operations and plant in the works of the Richmond Gas Company, and of the Croydon Gas Company, at Waddon. This discourse he supplemented by another dealing with the flora and fauna of the coal measures, or, rather, with their structure as shown by a remarkably fine series of photographs taken in the microscope. The lecturer exhibited on the screen photographs of fossil specimens of plants of the coal measures—such as the lepidodendra, lyginodendra, sigillaria, and coniferæ—and followed each with photo-micrographs of coal showing the structure and indicating in many cases the remarkable correspondence with plants of the same genus existing at the present time. In the case of the lepidodendra, the high-power photo-micrographs showed a structure of innumerable spore-cases and spores, rich in resinous material, and indicating the burning qualities of the coal. Dr. Rodman is an expert microscopist; and no doubt the technical difficulties of the work have interested him as much as the evidence the results supply of the materials and processes concerned in the formation of coal. It is hardly possible, however, to imagine finer photographs of coal structure as seen under the microscope than those shown by the lecturer in illustration of his subject.

BENZOL PRODUCTION IN AMERICAN COKE-OVEN PLANTS.

The United States Geological Press Survey Bulletin, No. 254, contained an article to the following effect.

In response to the demand for high explosives, a new industry, the recovery of benzol and toluol, suddenly sprang into existence in the United States in 1915. Before the European War the demand in the United States for these products was so small that but one company engaged in coke-making sought to recover them on a large scale. Late in 1914 the price of benzol and toluol rose to such a point that other companies built plants to recover these oils from the gas; and by the end of 1915 there were nineteen new plants for benzol recovery in operation and others in course of erection.

Reports to the United States Geological Survey, by bye-product coke plants, indicate that the output of benzol and other light oils in 1915 amounted to 13,942,763 gallons, in connection with which there were produced 761,256 lbs. of naphthalene. Several of the plants are not equipped to separate the different oils found; and 7,322,670 gallons (more than half the total output) was crude benzol and light oil, and was shipped to refineries connected with powder works and other chemical industries. In the 6,620,093 gallons of oils refined at the place of recovery, there were 4,833,939 gallons of 100 per cent. benzol, 1,315,727 gallons of toluol, and 470,425 gallons of solvent naphtha. Thirty-one coke-making establishments with 4933 bye-product ovens contributed to this total; and it is estimated that between 8 million and 9 million tons of coal were carbonized to furnish the gas from which the oils were recovered. The annual capacity of the benzol-recovery plants now in operation is estimated at over 20 million gallons, and with the completion of the plants now building will probably exceed 22 million gallons. The value of these products is indicated by the prices currently reported during the year. Benzol, normally selling for 20 c. or less a gallon, in September brought as high as \$1·25 for immediate shipment and 65 c. on contract; toluol, with a normal price of 25 c., was sold for as much as \$6 a gallon for immediate delivery and was contracted for at \$4·25 per gallon.

Benzol is an excellent motor fuel; but the United States with an output of gasoline estimated in 1914 at 30 to 50 million barrels (1500 million to 2500 million gallons), stands in no need of additional supplies for this purpose. There is, however, in normal times a large use for dyes and chemicals, such as carbolic acid, which depend upon benzol and toluol for raw material, and which have in the past been largely imported from Germany, either as finished or as intermediate products.

ENGLISH OIL SHALES.

Gauging the Contents of Horizontal Cylindrical Tanks.

A paper on "Oil Shales, with especial reference to those of the Dorsetshire Kimmeridge Series," was read by Mr. W. HARDY MANFIELD before a meeting of the Institution of Petroleum Technologists on Tuesday last. The chair was taken by Sir Boverton Redwood, Bart., F.I.C., Assoc.Inst.C.E.

The author reviewed the principal oil shales in the world, and proceeded to refer in detail to the deposits which occurred in England in the Kimmeridge shale in Dorsetshire. He traced the course of the Kimmeridge measures from Dorsetshire to Yorkshire, and gave a history (taken from a memoir by Burton Green) of the early efforts at working the Kimmeridge shales in Dorsetshire. He said that the natural gas at Heathfield in Sussex probably came from Kimmeridge shales. He had not heard why the Company which was formed to utilize this natural gas for lighting, heating, and power purposes did not accomplish more than it did; but possibly the bore-holes had been too close together. In addition to the outcrop on the coast near Kimmeridge, these shales have been proved to exist in considerable quantities at points further west—more especially at Ringstead and Portesham. They could, in the author's opinion, be best won by the "long wall" method of working; but in some places they might be worked by open-cast methods.

After describing briefly the development of methods of retorting shale in Scotland, Mr. Manfield expressed the view that many of the shales, especially of the lower grade, might be more profitably worked if the distillation were effected at lower temperatures. He said that experiments with Kimmeridge and other shales have shown that retorting at the lowest temperature that will distil the shale improved both the yield and the quality of the oil; but after the oil had been obtained, the temperature must necessarily be considerably raised, in order to get most of the ammonia. He then mentioned the Tarless Fuel Company's and the Del Monte methods of low-temperature working. The Kimmeridge shale in Dorset is rich in ammonia; the seam which gives the most oil yielding 45 lbs. of sulphate per ton of shale, while seams poorer in oil give more sulphate. The cost of the sulphuric acid necessary for converting the ammonia into sulphate might be saved if the sulphur were taken direct from the vapours. Probably this might be done by the Burkheiser process, as applied to coal gas, though there appeared to be an objection from the agriculturist's standpoint to any considerable proportion of the salt being in the form of sulphite instead of sulphate. It was the difficulty of removing the sulphur from Kimmeridge shale oil which had hitherto prevented the successful working of this shale. Oil from the best Kimmeridge shales distilled in the ordinary way contained from 5 to 8 per cent. of sulphur. The sulphur compounds in the oil were formed at a very low temperature, and when once formed were very difficult to destroy. Endeavours had been made to remove the sulphur from the shale itself, or to prevent its association with the oil; but the process followed was not commercially available. Drastic treatment of the oil was out of the question, as the sulphur compounds were more stable than its constituent hydrocarbons. Till a method of desulphurizing shale oil was devised, the vast resources represented by the Kimmeridge shales for the supply of motor spirit and fuel oil would not be available.

The discussion on the paper was opened by Mr. E. H. CUNNINGHAM CRAIG, who referred to the geological aspects of the Kimmeridge shale measures. Sir THOMAS HOLLAND attributed the success of the Scotch oil industry largely to its having had the benefit of Scotch persistence and skill. Professor J. CADMAN congratulated the author on the exhaustive review he had given of the history of oil-shale working in Great Britain. Other speakers referred to the desulphurizing question being one for investigation by chemists. Mr. W. J. A. BUTTERFIELD hoped that, in view of the reference to Heathfield natural gas, the author would have also mentioned whether there was any connection between the Kimmeridge shale measures and the supplies of natural gas in Holland and Germany, which had lately been developed to a large extent near Hamburg, and now furnished about 15 per cent. of the gas supplied to that city. He first became acquainted with Kimmeridge shale about twelve years ago. In regard to the utilization of the sulphur in the shale for the manufacture of sulphate from the ammonia, it would be necessary, in order to employ the Burkheiser process, that the sulphur should be liberated in the form of sulphuretted hydrogen. He believed that a relatively small proportion of the sulphur in the oil vapours from Kimmeridge shale was in this form. In regard to the suggestion that the shale should be retorted at a low temperature for the liberation of the oil, and the temperature of the retort subsequently increased in order to obtain the maximum yield of ammonia, he would point out that if it were desirable to work at different temperatures with this end in view, the material should be passed from a retort at the low temperature to another retort at the higher temperature, as it would be technically uneconomical to delay operations in order to raise and lower the temperature of one and the same retort. The question of the desulphurization of Kimmeridge oil was one which commercial men would find would well repay further study at the hands of chemists. He and another speaker inquired if the author knew if nascent hydrogen had been applied in conjunction with a catalyst for removing the sulphur from the oil vapours, on the lines of the Evans process for the purification of coal gas as adopted by the South Metropolitan Gas Company. Mr. MANFIELD, in the course of his reply to the discussion, said there was a sufficiency of sulphuretted hydrogen in the gas and vapours evolved in the retorting of Kimmeridge shale to form sulphuric acid for the neutralization of the whole of the ammonia. He did not himself know of trials of a catalyst in the purification of the oil, though its use for the purpose had been patented.

A short description was then given by Messrs. LUIS DE FLOREZ and E. L. LOMAX of a new method of ascertaining the contents of any horizontal cylindrical tank. The method is obviously applicable to all horizontal cylindrical tanks, whether used for petroleum, or tar, or tar oils, and may therefore be of interest to readers of the "JOURNAL." The volumes of the contents of any horizontal cylindrical tank if plotted in a curve represent a double parabola, each parabola representing half of the tank. If, therefore, a true parabola is plotted on a percentage scale, a graphic representation of the percentage volume of the cylinder in the ratio of the percentage height is obtained. The only further figures necessary for the calculation of the contents of the tank at any dip are its diameter and total contents when completely filled. This gives a graphic method of estimating the contents of a tank at any dip—the calculations being in this way reduced to a minimum.

The late Sir Henry E. Roscoe, whose death occurred last December, left estate of the value of £44,871, with net personalty £44,787.

The annual meeting of the Institution of Mechanical Engineers was held last Friday. Among the items of interest to "JOURNAL" readers in the Council's report was a statement that premiums of £5 each have been awarded to Professor A. H. Gibson, D.Sc., and Mr. W. J. Walker, B.Sc., for their paper on the "Distribution of Heat in the Cylinder of a Gas-Engine;" also that a grant of £15 was made from the "Bryan Donkin Fund for Original Research in Mechanical Engineering," to Mr. Arthur H. Barker, in aid of his Research at University College, "to investigate a new method of determining the radiant temperature and air temperature in a room." The Council announced that Mr. Harry E. Jones (a member) has accepted their invitation to deliver the "Thomas Hawksley Lecture" this year.

COAL HANDLING AND CARBONIZATION.

By James Dickson, of Kirkintilloch.

[A Paper read on Saturday, Feb. 19, before the Scottish Junior Gas Association, Western District.]

The matter of which I shall speak is my own personal experience as obtained at the Kirkintilloch Gas-Works. The subject is, I believe, the all-important question in a gas-works, as the late Mr. Henry O'Connor often mentioned in his lectures to students that the profits in a gas-works largely depended upon the results obtained in the retort-house. Our works are comparatively new, having been built only seven years ago. They were visited by the Association four years later; so I need not describe them, but will just confine myself to such parts as are pertinent to the treatment of my subject.

Coal Handling.

With regard to coal handling, I do not think a great deal can be claimed by any individual as to any saving exercised in this direction—of course, I mean in smaller or medium-sized works (say) carbonizing up to about 40 tons of coal per day, and where horizontal settings with hand charging are used. The position of the works with regard to railways or other means of transport will be the determining factor as to the cost of the work. For any special saving we must, ere we build works, thoroughly consider this matter, and only build where means of transport—either for imports or exports—will be best served and with greatest economy. Works, of course, with no railway accommodation, are placed at a great disadvantage by their having to pay for the extra handling and cartage of all material necessitated by want of railway facilities.

The matter of convenience in coal-handling appears to have been well thought out, ere our site for the works was chosen. They are not in the natural position one would expect—being at an altitude of about 50 feet above the lower part of the town, where the old works were situated. But, as I have already said, it is just when one considers fully the question of oncost, in its relation to economy, that the necessary foresight requires to be displayed.

With us, we feel we have benefited to the fullest extent by this consideration, as we have a railway running through both sides of our retort-house—a building 96 ft. 6 in. long by 150 ft. 6 in. broad. The bench is in the centre, with the railway running on either side between it and the coal-stores. The line of rails determines the extent to which our coal-store can be extended; but it will allow us a depth of 25 ft. 6 in., so that we have a store of considerable dimensions. At the present time we have in the west section a reserve stock of 850 tons, which has not been interfered with for fully two years. On the other side of the house, is the same depth of coal-store, but its length is somewhat reduced because of a door which forms the entrance to the coke-yard, through which all the char from the retort-house passes. The length of this store is 80 feet, and so is capable, if filled to the same height as the other, of carrying 700 tons. For our every-day working, these railways inside can quite comfortably hold eleven waggons between them. Therefore we have, taking each waggon at 8 tons, (say) 88 tons upon which to work. Thus we have far above our actual requirements for any one day or even a week-end; and not only have we this, but with our railway running out through the retort-house, we have space on both lines on either side, for four waggons in each, so that future requirements are well provided for.

Our coal is almost entirely handled by the stokers. It is filled by them into their bogies direct from the waggons. In this way there is seldom any cost incurred in handling other than this. We endeavour so to arrange our supplies that just sufficient is delivered to meet our actual requirements. That we have been fairly successful this year in maintaining proper regulation of our traffic is in no way due to any special favours on the part of our contractors, but rather to the fact that our yield of gas per ton has been increased by fully 20 per cent., which also represents the amount of coal saved, as contracted for.

Our present rate of cost for coal-handling and carbonizing is exactly 2s. per ton. This also includes the discharge of coke into the yard ready to be loaded into waggons. Of course, as it is necessary to carry a stock of coal, this incurs extra labour and extra cost. We endeavour to stock 1000 tons; and we find that to do so the past five years has, on an average, cost ¾d. per ton of coal carbonized. Adding this to the 2s. already mentioned, our carbonizing and coal-handling costs us 2s. 0¾d. per ton. At the old works, with less favourable conditions, but with a much lower rate of wages, the cost per ton amounted to 2s. 8d. Thus, something is possible to be saved if this subject is fully and carefully studied before proceeding with the construction of any works. The saving is, I think, to be found by getting direct handling by the stokers without any additional labour, as the stokers have to fill their own coal in any case. If, therefore, this is secured, one can save considerably in the cost of handling coal. In comparing the cost of coal handling with that of our old works, I might say that at the old works every pound of coal had to be double handled—having to be emptied by the labourers into the store and then lifted into bogies and conveyed to the retort-house for carbonization.

New Works.

Cost of coal handling by stokers	2s.	0d.	per ton.
Cost of stocking coal	0	0¾	,,
Total cost	2s.	0¾d.	,,

Old Works.

Cost of coal handling by stokers	2	5	per ton.
Cost of stocking coal	0	3½	,,
Total cost	2s.	8½d.	,,

In reviewing these figures, a saving of 7¾d. per ton is shown. The greater part of this is saved in handling by stokers, whose charges are all weighed out to them on two platform weighbridges placed on a convenient spot on each side of the retort-house. Our stokers were always supposed to handle 3 tons of coal per shift; but this was never maintained, so long as they were allowed to put in what suited themselves. It was with this knowledge, therefore, that we adopted the present system of weighing all charges, which has brought about a saving of 5d. per ton over the old system. I think from these figures, you will agree that our efforts have been well rewarded. There was at first, considerable trouble when the men found out that they had been working at a low level with regard to weight; but by foresight, the trouble was prevented from becoming a menace. Previous to this we entered upon an agreement with the men, that a rise of 3d. per shift would be granted to them on the adoption of the system—pointing out to them that heavier charges with longer duration reduced the number of operations from 24 to 18. Their grievance then soon ceased.

With the saving of 7¾d. per ton shown, it might be thought that my figures are not consistent with my belief in what I at first stated as to the saving in coal handling; but as this method of operations could quite easily have been adopted at our old works with the same comparative saving per ton, I still contend that our principal economy, and the only saving that was possible to get (had the men been properly watched with regard to the weight of coal handled), would have been the 2¾d. in direct handling from the waggon. Of course, the nature of our new works allows for more efficient and easier labour for the men.

Carbonization.

There can be no gainsaying the importance of this subject. Much has been, and is still being, said concerning it. Eminent men have disclosed ideas (many of which are hostile to the present mode of carbonization), thinking that much more could be taken from the coal and its residual products than has hitherto been the case. Personally, I feel akin to some of these ideas, especially that which Mr. Cranfield brought before us at our last annual meeting. His idea was to supply a gas of lower value, whereby it could be made much cheaper and serve all purposes equally as well as our gas to-day, be it for power, incandescent lighting, gas-fire, or furnace heating, or for any other ordinary domestic or commercial use. Of course, in the matter of flat-flame illumination, exception would have to be taken to this, which would prove of no value. But, the fact is that, at present, the light obtained by this means in any town's gas is not of much consequence; and not only so, but it is so much more extravagant with comparatively no efficiency against an incandescent gas-burner, that people who really desire a good light would not consider of much importance the loss of such an illuminant as flat-flame gas.

Our retort-bench consists of twelve ovens, built back to back, six on each side, having eight retorts in each oven—thus giving us in all 96 retorts. This retort strength is capable, at the past rate of increase, of meeting our requirements for very many years, and more especially if we consider the results obtained by us in the present year. At our heaviest period of gas making this year, we had forty retorts in use; while for doing the same amount of work in former years, we had fifty-six retorts in use. Thus you see that, while in the past at our maximum make we had reserve retorts to the extent of 70 per cent. this year, we had at our maximum season 140 per cent. reserve retorts, or the reverse conditions from last year—namely, forty retorts in use and fifty-six idle against fifty-six in use and forty idle. Of course, with the advance of years, and the advent of incandescent lighting now so generally used, the way has been opened-up for greater achievements in the matter of carbonization, as this eliminates to a great degree the necessity to supply gas of such illuminating power as would please the public in their notions of what this should be, and which would have been impossible of attainment in older days, and from such coals as are available at the present time, at a moderate price.

While I have said this, I do not agree that the question of candle power has with us altogether been neglected; but I might say that we are yet well within our prescribed limits, as we supply gas of 15½-candle power. For us to secure the results we now have means considerably more attention in the matter of maintaining heats and keeping the settings in good working condition. This is a continuous job, as in a matter of twenty-four hours, if the fires are neglected, the effects very readily show themselves. In the working of our settings, we have a fixed time for cleaning the producers; so that such a period will be convenient for inspection being made during the ordinary working day. The flues and air-ports are set for the men, and they are not allowed to interfere with their setting; but we find that they scarcely ever need alteration. Our chimney draught is maintained at an almost constant vacuum of between 5-10ths and 6-10ths. Our draught gauge is fixed in the engine-house; so that it is always before our notice, and if need be we have the warning to make such alterations in our flues as will best suit the conditions of draught.

Any little trouble that does arise is due to the fur which collects inside the flues. But this is seldom; and if cleaned out (say) once in six months, the trouble is avoided—providing that vigilance is exercised over the men in their duties. Our heats are maintained very regular; and to this, with good hydraulic main and exhauster attention, we attribute the more efficient manufacture of gas, and the higher yield per ton.

Our retort charges vary with the position of the retorts. The centre retorts are generally the hottest; so we charge them with 3¾ cwt. of coal; the sides, with 3½ cwt. each; while the bottoms which are reasonably always of lowest temperature, are charged with 3¼ cwt. The temperature of the retorts as we have them-is 2156° Fahr. centres, 2084° Fahr. sides, and 2012° Fahr. bottoms —working, as I have already stated, with the varying charge in each pair of retorts for a duration of six hours. Maintaining such heats as these, we use more fuel than we otherwise would; but I think that we have made up this deficiency by producing with these higher temperatures a harder coke and one which gives very little breeze.

Our sale of coke from May 15 to Jan. 31 was 9·27 cwt. per ton of coal carbonized; while last year for the same period the yield was 9·79 cwt. Against this, we have further to put the loss in breeze. For our own use, we have had to purchase breeze elsewhere for boiler-firing—our make of it being inadequate to meet requirements. Since May 15 we have purchased 220 tons 15 cwt. of breeze; and of this quantity we have now in stock about 50 tons. But even at that it means fair purchase, as in older days, when our make was much smaller, we could quite well afford to sell considerable quantities of breeze after having satisfied our own requirements.

Another trouble which we have solved with this means of working is the carbon. We have never once required to scurf our retorts this season. The carbon when it gets about ¼ inch thick falls off. Frequently we have large sections of it drawn out with the charge. Thus we can more easily heat the retorts with the absence of such a bad heat-conductor upon the inner surface of them. This also gives us constantly the full capacity of the retort; so that no difficulty is experienced in putting in the full amount of coal. When working in past years in our heavy season we very often had a considerable area of the retorts occupied by carbon, which might have been extra gas measured and passed into the holder.

The reason we attribute for this is the fact that we charge our retorts as rapidly as possible; so that within the shortest space of time, all the mouthpiece doors are closed-up. We then increase the pull on the exhauster for about a half to three-quarters of an hour; and this is the period wherein the greatest achievement is to be got. I might also say that we have abandoned the use of our retort-house governor and compensating steam-throttle valve on the exhauster engine. We found that the retort-house governor served no useful purpose; and the compensating control was not sensitive enough to answer the small increases and decreases in the pull which we found necessary to maintain the conditions required. We therefore thought it best to abandon their use altogether.

The hydraulic main, as I have mentioned, is a thing of much importance, which with us also has had a great deal of supervision. We endeavour to maintain a seal of about ¼ inch, and run the exhauster to suit the quality, as shown by the jet photometers. One of these instruments is placed on the retort-house wall, while the other is in the engine-house, inside a case on the window, which can be seen from either inside or outside. When therefore the engineman who attends to the exhauster is doing his other duties, he has always under his eye the quality of his make. At first when we considered such a scheme as having enginemen for these separate duties, we were very reluctant to instal such men, as the leading stoker (who was paid a little extra per shift) had hitherto performed the duties connected with the exhauster and steam-boiler. But now, since we have experienced their value, we consider the change was amply justified.

With regard to the quality of gas, it is an indisputable fact that (within limits) the higher the make per ton, the greater will be the tendency to reduce the thermal efficiency of the gas. With us I may frankly say that we have reduced our standard. But this has proved for us an advantage, as now, with our lower standard, we must maintain it regularly, and consequently we have less complaints now than in former years. At first we supplied a gas of 19-candle quality; but with this, any difference in quality gave rise to complaints not so much of bad gas, as invariably the cause was attributed to dirty gas. When the light got a little bad, the consumer, by turning on more gas, generally improved it, but, unconsciously to him, as the gas regained its standard the admixture was too rich, thus giving rise to a deposit of carbon upon the mantle.

Before embarking upon the system of securing high yields of gas per ton of coal, it is necessary for one to count the cost, and see whether or not it will be best in the final reckoning to follow such a course. Up to two years ago (for four years in succession) we showed a profit on the residuals over the cost of coal and other raw material brought into the works; but with a lower yield of gas and the extra cost in handling the greater quantity of coal and residuals, the cost per 1000 cubic feet showed no better results. On the other hand, the extra working added to the charge for maintenance of plant and to the difficulties in the winter season of procuring deliveries of coal and selling the residuals. Our average make per ton will give us this year at least 12,000 cubic feet; while six years ago, our make per ton amounted to only 8924 cubic feet. This, I think, when compared with the results obtained at that time, leaves no doubt that we have chosen the better part in launching out for our present attainments.

DISCUSSION.

Mr. John Wilson (Falkirk) remarked upon Mr. Dickson's advocacy of low-grade gas and the abolition of flat-flame burners. But it must be remembered that the flat-flame light was the only one that could be successfully used in engineering machine shops. The provision of the flat-flame light was a thing they really required to face. If they were not going to supply gas suitable for flat-flame burners, then they should promote some scheme whereby they could enrich the gas for those works where it would be consumed in such burners. He did say that they ought to listen to what those people who were using gas in the machine shops were saying, because they were going to be up-against it so far as the engineering shops were concerned. Mr. Dickson said that the temperatures in the retorts varied round about 2000°. How did he arrive at these temperatures, and where was the reading—was it in the retort or in the combustion chamber? As to the falling off of the carbon in layers, why did it happen when it did not do so formerly?

Mr. John Frazer (Dalmarnock) was baffled by the statement that the Kirkintilloch coal storage cost was ¾d. per ton. They must get their coal stored very cheaply. He was doubtful as to how the figure was arrived at; and he did not see how there could be any difference in the storing of the coal between the old and the new process. It was his opinion that the falling off of the carbon in the retorts was due to the great amount of attention paid to the hydraulic main.

Mr. D. T. Marwick (Dawsholm) expressed his amazement at the big make. Mr. Cranfield had given them a lecture on low-grade gas; but he had not said it was all air that went into low-grade gas. He had his doubts that the 12,000 cubic feet were obtained legitimately. Though he believed in low-candle gas to an extent, he felt the consumer was "paying through the nose."

Mr. Alexander Wright (Lockerbie) said he had been thinking of a retort-house governor for his works; but Mr. Dickson decidedly stated that the retort-house governor was of no use. He had always understood it was of great value; but if it were valueless for Mr. Dickson's works, it might be of use for a smaller establishment. In all other views he had heard expressed, and in all addresses he had listened to, the retort-house governor was defined as being of great advantage.

Mr. Thomas Moffat (Tradeston) said he was very much of the opinion of Mr. Dickson. Regarding the seal, they would find in taking down the hydraulic main that what had been ¼ inch was perhaps about 2½ inches, and that there was fluctuation in the main all the time.

Mr. James Bell (Kirkintilloch) said that, without hesitation, he could assert that the retort-house governor, instead of being a benefit, was a drawback. What was the use of throttling-down, and thereby increasing the work of the exhauster? They wished to give the gas as free a passage as they possibly could. On the other hand, the up-keep was excessive. The governor bell, in his experience, might only last six months, and this was a serious matter. The effect of the retort-house governor in throttling-down the gas and putting extra work on the exhauster was a thing to be avoided. With regard to the magnitude of the make, there were works that were producing 14,000 cubic feet of gas per ton. They must, of course, be getting a lot of air in it.

Mr. G. T. Purves (Auchengeich), dealing with the fall of carbon in the retorts, said that Mr. Dickson had referred to low seal and other factors. But none of these factors in perfection would stop carbon. He could say that the fall of the carbon was due more to heavy charging than steady pull.

The President (Mr. David Fulton) said that if the cost of handling the coal was only ¾d. a ton, Mr. Dickson must have had very little ingoing and outcoming during the last five years. The wages figure of 2s. per ton was exceedingly low. If the stoker dealt with 3 tons of coal and got 6s. a shift, he alone was responsible for 2s. a ton. But these were the wages of the exhausterman; and they must be included in the carbonizing wages. Mr. Dickson was wrong in his interpretation of the views of experts on the gas production ideal. The idea was high heat and high yield of gas, whereas Mr. Dickson had contended for the opposite. On the question of the flat-flame burner, he thought the incandescent light could be used everywhere.

Mr. Dickson, in reply, in dealing with the difficulties of the retort-house governor, said that immediately one charged up one obtained an extra evolution of gas. Consequently, they had to put extra weights on the governor. He might remark that they had engineers in their district content to use the incandescent light. The retort temperatures alluded to had been taken within 2 feet of the back of the retort. These temperatures were fairly high for ordinary horizontal retorts; and they were not obtained without great supervision on their part and much attention to cleaning. The carbon trouble was solved by the extra pull they had when the retorts were newly charged. With regard to the cost of coal handling, they so arranged their supplies that they had almost sufficient to meet their immediate requirements; so that there was little ingoing and outcoming from store.

NOTES ON PURIFICATION.

By William Bennett, of Greenock.

[**A Paper read before the Scottish Junior Gas Association, Western District, Feb. 19.**]

The subject of purification is one of considerable importance and well worthy of an interesting discussion, which the writer hopes will follow the reading of these notes.

Briefly, the impurities in crude coal gas consist of aqueous and tarry vapours, carbon dioxide (CO_2), sulphuretted hydrogen (H_2S), ammonia (NH_3), carbon bisulphide (CS_2), with other sulphur compounds and cyanogen bodies. The amount present of each of these impurities depends on a variety of factors—such as the coal itself, its physical condition, the moisture content, the duration of charges, temperature, and method of carbonization. Where vertical retorts are in use, the regulation of the heat is a factor governing the amounts of impurities produced—that is, the impurities are different when working good top heats than when there is a fairly long uniform heat. This regulation of heat in verticals opens up a wide field for discussion, and can be more suitably dealt with in a paper on vertical retorts.

It is essential that the tar and tar-fog be removed to the fullest extent; otherwise much trouble will be caused in the purification plant, owing to the "clogging up" of the brushes and filling material in the scrubbers and the oxide in the purifiers, rendering the former inefficient, and causing excessive back-pressure to be thrown by the latter.

The thick tar should be removed quickly before the condensers and while the gas is still fairly hot—say, about 140° to 160° Fahr. This will prevent the undue absorption of the light hydrocarbons. The light tars and tar-fog must, however, be effectively removed before the gas enters the scrubbers, and care should be taken that all tar, after condensing, is removed at once out of contact with the gas; otherwise, if allowed to flow with the gas, the tar will give back naphthalene vapours to the gas. This was very noticeable with us when working with horizontal retorts. The tar in the seal-pot of the tar-extractor and inlets to the well gave off considerable quantities of naphthalene, which deposited on the seal-pot cover and crown of the well, just as ammoniacal liquor flowing into the open gives off NH_3. With gas from the verticals the naphthalene content is very low, and we do not find the same effects.

The removal of carbon dioxide by lime purification is rightly almost a process of the past. Since the addition of carbon dioxide only reduces the calorific value *pro ratâ*, then so long as we can keep the CO_2 content down to reasonable limits, we ought not to concern ourselves about its complete removal. What we should aim at is a gas of nearly uniform composition and calorific value.

With regard to the removal of CS_2 and sulphur compounds other than H_2S, providing they can be removed simply and at little cost no one will object to doing so. But unless found in abnormal quantities, their presence is of such little consequence that we are not at all justified in complicating the plant or adding materially to purification costs.

There is without doubt a certain corrosive action going on in meters, service-pipes, and gasholder plates, due to the presence of cyanogen; and this action is increased by the traces of ammonia and oxygen often present in the gas—ferrous ammonium ferrocyanide ($Fe(NH_4)_2Fe(Cn)6$) and prussian blue ($Fe_7(Cn)18$) being formed. In the paper "Notes on the Corrosion of Service-Pipes" read by Mr. Macleod before the Institution of Gas Engineers in 1911, analyses were given of several deposits taken from the services in Greenock, all of which showed the presence of cyanogen. This internal corrosion is not only detrimental to the pipes and fittings, but also forms a nucleus for the deposition of naphthalene, often resulting in final stoppage. The cyanogen also locks up a certain amount of the purifying material by combination, and forms a protective coating round some of the oxide—thus preventing complete sulphiding. With vertical retorts in use the cyanogen content is low; but with horizontal retorts and high temperatures, and consequently a greater amount of hydrocyanic acid, it may be advisable to remove it altogether in some portion of the plant preceding the purifiers. The ammonia and sulphuretted hydrogen must, of course, be completely removed before sending the gas out to the district.

The removal of the above impurities commences immediately the temperature of the gas takes the down-grade; but apart from tar extraction, and partial naphthalene removal, the gas reaches the washers or scrubbers before we have much control over the operations. From six-tenths to seven-tenths of the ammonia yield is condensed out with the aqueous vapour in the hydraulic mains and condensers. This virgin liquor, having condensed out at comparatively high temperatures, contains but little H_2S and CO_2, and, instead of being allowed to flow into the common well, may be separated from the tar and afterwards used in the scrubbers, where it can be usefully employed to remove CO_2.

It is intended in these notes to deal but briefly with washing and scrubbing, and to go more fully into questions concerning dry purification by means of oxide of iron. At the inlet of the scrubber the NH_3, CO_2, and H_2S may be taken to be present to the extent of, roughly, 130, 3000, and 800 grains respectively per 100 cubic feet of gas.

As you are well aware, the removal of ammonia is effected by taking advantage of the great solubility of ammonia in water. At ordinary temperatures and pressures, one volume of water dissolves about 760 volumes of NH_3, three volumes of H_2S, and one volume of CO_2. These figures are correct only when the absorbent water is brought into intimate contact with the pure gases and full atmospheric pressure is maintained. When dealing with mixed gases, such as crude coal gas, the pressure exerted by each constituent is the same as if it alone were present and occupied the whole space. That is to say, if the percentage of NH_3 present is 0·4, then the pressure exerted by the NH_3 is the same as if 0·4 cubic foot of ammonia was expanded to 100 cubic feet, or $\frac{1}{250}$th of the total pressure.

By Henry's law, the volume of a gas absorbed is directly proportional to the pressure exerted by the gas; so, if dealing with clean water, the NH_3 absorbed would only be $\frac{1}{250}$th of the above. Further, given a fixed temperature, liquors of varying strength have certain ammonia pressures. The pressure varies directly with the strength. If this pressure is greater than the ammonia pressure in the gas, then ammonia will be given up to the gas. If the ammonia pressure in the gas is greater than that in the liquor, then ammonia will be absorbed. To put it another way, ammonia molecules are constantly leaving and entering the liquor, and equilibrium is established when the same number of molecules leave and enter the liquor in the same time. If the pressure of the gas is increased, more molecules of ammonia enter the liquor in a given time and a greater volume is absorbed, until the strength of the liquor is increased to give a pressure to balance the increased ammonia pressure in the gas. Consideration of this fact leads to the conclusion that in principle it is wrong to place a washer on the exhaust side as is sometimes done. The pressure exerted by the last traces of ammonia is so small that it is extremely difficult to get it into solution.

The absorption of ammonia increases with a decrease in temperature of the washing water; but the temperature should not be too low, otherwise ethylene and benzene are thrown out. Other actions take place besides the absorption of ammonia in water; ammonia having an affinity for both the H_2S and CO_2, as represented by the following equations:—

$$(1)\ NH_4OH + H_2S = NH_4HS + H_2O$$
$$(2)\ 2NH_4OH + H_2S = (NH_4)_2S + 2H_2O$$
$$(3)\ NH_4OH + H_2CO_3 = NH_4HCO + H_2O$$
$$(4)\ 2NH_4OH + H_2CO_3 = (NH_4)_2CO_3 + 2H_2O$$

It will be seen from an examination of these equations that, even if we could utilize all the ammonia in the gas and have the most favourable chemical actions—namely, (1) and (3)—taking place, there is not anything like the amount of ammonia present for complete purification at this point. Self purification, or the extraction of the H_2S and CO_2 in the gas by the NH_3 also present, has been, and still is, a fascinating problem for chemical engineers, and many processes have been brought forward with a view to utilizing the ammoniacal liquor over again after expelling the H_2S and CO_2, in order to make up for the initial shortage of ammonia required for the complete elimination of the above impurities.

None of the processes brought forward is, however, so simple and sure in its actions as to warrant the disuse of the efficient, if somewhat cumbersome, method of oxide purification. The acid radical CO_2 is a stronger acid than H_2S, and will turn out the latter from combination with ammonia. This being so, it should be endeavoured to so arrange the plant that the liquor is kept in contact with the gas for a lengthened period, in order that the CO_2 shall largely be absorbed at the scrubbers and the H_2S driven forward to be dealt with by the purifiers. Another point to be noted is that where liquor is sold on a distillation test, no credit is given for the sulphur content, which, under present methods of oxide purification, means a direct loss of revenue. Further, where the cyanogen is not specially extracted, the lengthened liquor contact will—where the air for revivification is admitted before the washers—reduce the cyanogen content of the gas by forming ammonium sulphocyanide. In this case there will be a slight loss of sulphur and the fixing of a little ammonia. Working in this way, the liquor can be made to take up about five equivalents of CO_2 to one of H_2S, and at the same time the strength of the liquor be brought up.

Dry Purification.

As already stated, the use of lime is being rapidly abandoned. The frequency of changes required, the cost of the lime, and the nuisance when spent, made it far from being an ideal material.

With the abolition of the sulphur clauses, purification by means of oxide of iron quickly sprang into general favour. Unlike lime, it is limited in its action to H_2S, and under certain conditions HCn and possibly CS_2, the CO_2 passing forward unchanged. The fouled material is readily revivified and made ready for use again.

Formerly the usual procedure was to have three out of four boxes working, with one off for emptying and revivifying. When the gas showed foul on entering the third box, the sequence was altered, so that No. 2 became the first and the clean box was placed last. The first box, now foul, was then shut off and opened out; the material being spread in the open for revivification purposes. The following represent the reaction taking place:

$$\text{Sulphiding}\ \begin{cases} 2\,Fe_2O_3H_2O + 6\,H_2S = 2\,Fe_2S_3 + 8\,H_2O \\ 2\,Fe_2O_3H_2O + 6\,H_2S = 4\,Fe\,S + 2S + 8\,H_2O \end{cases}$$

$$\text{Revivification}\ \begin{cases} 2\,Fe_2S_3 + 3O_2 + 2\,H_2O = 2\,Fe_2O_3H_2O + 6\,S \\ 4\,Fe\,S + 3O_2 + 2\,H_2O = 2\,Fe_3O_3H_3O + 4\,S \end{cases}$$

The oxide was thus brought back to its original state with the deposition of free sulphur. The result is just the same as if the oxide merely acted as a catalytic agent for the oxidation of the H_2S, thus:

$$6\ H_2S + 3O_2 = 6\ H_2O + 6\ S$$

After revivification the oxide was returned to the box which was placed last in the series, when another change was made. The number of changes required to bring the sulphur up to 50 per cent. varied from 12 to 14. The process was both expensive and offensive—gas being lost at each change, and heat evolved when revivifying, causing unpleasant odours to arise.

The next step made was the introduction of oxygen (as air) along with the gas, so that revivification would go on at the same time as sulphiding. This was a decided advance on the former practice, and the number of changes required was reduced. Working as before, however—that is, the foulest box first and the clean box last—it was found impossible to get the theoretical quantity of oxygen taken up.

From the equations given above there appears to be no chemcal reason why the actions should not go on indefinitely if the right amount of oxygen (as air) be admitted and the conditions be such that the actions go on at equal rates. The only reason for any change is increase of bulk causing excessive compactness and prevention of intimate contact between gas and oxide by deposition of sulphur. Other factors, however, enter into the question; but these will be dealt with later. For the moment look at it from the point of view represented by the above equations. Why should the oxygen not be taken up to the full extent?

Quantitative tests have been made of the H_2S and O_2 in the gas at the inlets of each of the boxes. These tests bring out the fact that the sulphiding action and oxidation of the sulphides formed do not take place to any extent side by side. Generally H_2S alone is taken up by the first box, the oxygen passing through untouched into the second and third boxes, which, being comparatively clean, offer but little scope for oxidation. The same with the fourth box where four are in use.

The next step that was undertaken was an attempt to separate the processes of sulphiding and oxidation in such a way that the oxygen passing through the boxes actively sulphiding would enter the boxes already sulphided and unaccompanied by H_2S. Under these conditions the oxygen is very active in the oxidation of the sulphides. This separation of H_2S and O_2 is brought about in two ways—either by "forward rotation" or "backward rotation." To work the system successfully in either way, the valves and connections to the boxes should be so arranged that the purifiers may be worked in any order. The Weck valve is really one of the best for this purpose. All four—where there are four—boxes are in use at the same time. This in itself is a great saving over the old method of three boxes on and one off—that is, 25 per cent. of the plant out of use. In the "forward rotation" method, the gas would be passed through series 1, 2, 3, 4, until showing pretty foul at the inlet of No. 3 box. The order would then be changed to 2, 3, 4, 1. This brings the foulest box last. Tests show that the H_2S is taken up by the first two boxes (now 2 and 3), while oxygen is being taken up actively by 4 and 1—the last two boxes. When the gas at the inlet to 4 shows sufficiently foul, or alternately when an excessive amount of oxygen is getting past the purifiers, the series is again changed to 3, 4, 1, 2. Nos. 3 and 4 now take up the H_2S while Nos. 1 and 2 are being revivified, and so on.

The following represents the series of changes:

1, 2, 3, 4; 2, 3, 4, 1; 3, 4, 1, 2; 4, 1, 2, 3; 1, 2, 3, 4.

When a box comes into the first position, it takes up about 95 per cent. of the H_2S entering the boxes, and continues to do so for three or four weeks—depending, of course, on the rate of flow. It is difficult to remove the remaining 5 per cent. in the second box; and it often happens that sufficient H_2S gets forward to the third box to give a foul test with lead acetate paper. It is difficult to explain why this should be.

The following tests were made on the purifiers at Greenock. The purifiers, which were seen when the Association visited Greenock some weeks ago, consist of six boxes, 40 ft. by 30 ft. by 6 ft. deep, with dry lutes operated by Weck valves—one for two boxes and one for four boxes. Hurdle grids are employed throughout. [See "JOURNAL," Sept. 9, 1913.]

Order of Working Purifier-Boxes 4, 5, 1, 2.

—	H_2S at Inlet.	H_2S Taken Out by Box.		Oxygen Taken Up per Cent. by Volume of Gas.
	Grains per 100 Cub. Ft.	Grains per 100 Cub. Ft.	Per Cent. of Total H_2S Entering Purifiers.	
No. 4 box	554·5	527·1	95·06	*Nil*
,, 5 ,, ...	27·4	20·6	3·72	*Nil*
,, 1 ,, ...	6·8	6·8	1·22	0·3
,, 2 ,, ...	0·0	0·0	0·00	0·1

It will be observed that although only 27·4 grains of H_2S per 100 cubic feet of gas enter No. 5 box, which is the second in the series, it only takes up 20·6 grains, leaving 6·8 grains to be dealt with by the third box (No. 1 in this case). In order to demonstrate for the purpose of these notes that No. 5 box was able, under suitable conditions, to take up much more than this, the series was altered immediately after the above tests were completed—5, 6, 1, 2 now becoming the series. Tests were made some 24 hours later.

Order of Working Purifier-Boxes 5, 6, 1, 2.

—	H_2S at Inlet.	H_2S Taken Out by Box.		Oxygen Taken Up per Cent. by Volume of Gas.
	Grains per 100 Cub. Ft.	Grains per 100 Cub. Ft.	Per Cent. of Total H_2S Entering Purifiers.	
No. 5 box	575·7	517·2	89·84	*Nil*
,, 6 ,, ...	58·5	49·0	8·51	0·05
,, 1 ,, ...	9·5	9·5	1·65	0·30
,, 2 ,, ...	0·0	0·0	0·00	0·10

It does not often happen that oxygen is taken up in the second box—No. 6 had been standing off for some time owing to having caked-up, and was in a very foul condition. This is probably why oxygen was taken up here. It will thus be seen that when in the first position No. 5 is capable of taking out 517 grains of H_2S, whereas when in the second position it is unable to take out 27 grains. The gas flow was the same in both cases, and the temperature of the box was 59° Fahr. in the first position, and 61° Fahr. when in the second position. One possible explanation of the above results is that the presence of HCn, if present as free acid, might retard the final purification; the tendency of the oxide to take up H_2S being partly neutralized by the tendency of HCn to liberate H_2S from FeS.

$$18\ FeS + 36\ HCn = 18\ Fe\ (Cn)_2 + 18\ H_2S.$$

In the presence of oxygen this Fe $(Cn)_2$ would be converted into prussian blue.

$$18\ Fe\ (Cn)_2 + 3O_2 = 2\ Fe_2O_3 + 2Fe_4\ [Fe\ (Cn)_6]_3.$$

If the above action proceeded at a slower rate than the action of H_2S on the oxide, the additional contact in a further box would complete the removal of the H_2S. This, however, can only be a partial solution of the problem, for it still leaves the question as to why the HCn in passing through the last box, which is in a very sulphided state, does not liberate H_2S, unless it be that the HCn is here reduced to such a dilution limit that it ceases to be active. It is held in some quarters that HCn does not act on FeS. If this be so, it may still, if present in large quantities, act as a poisoner, preventing the absorption of H_2S by the oxide. Apart from all this, the molecular concentration of the H_2S is very low, and the rate of chemical action will be correspondingly low also, requiring a larger mass in order to deal with it.

The following table shows the distribution of the H_2S and O_2 as indicated by tests made on the purifiers some time ago:

Series 1, 2, 5, 6, 3.

—	H_2S in Gas.		O_2 in Gas.
	Per Cent. by Volume.	Grains per 100 Cubic Feet.	Per Cent. by Volume.
Inlet of No. 1 box . .	0·820	507·0	0·40
,, 2 ,, . .	0·084	52·0	0·35
,, 5 ,, . .	0·022	13·6	0·35
,, 6 ,, . .	0·022	13·6	0·10
,, 3 ,, . .	0·006	3·7	*Nil*

H_2S and O_2 Taken out by the Purifiers in the Above Tests.

—	H_2S.		O_2.
	Grains per 100 Cubic Feet of Gas.	Per Cent. of Total H_2S Entering Purifiers.	Per Cent. of Gas by Volume.
No. 1 box	455·0	89·74	0·05
,, 2 ,, ...	38·4	7·57	*Nil*
,, 5 ,, ...	*Nil*	*Nil*	0·25
,, 6 ,, ...	9 9	1·95	0·10
,, 3 ,, ...	3·7	0·74	*Nil*

As a rule the extraction of H_2S is completed in the third box, and oxidation commences in this box also, possibly in the lower part. But the above tests showed a rather curious state of affairs. Slight oxidation took place in the first box, but sulphiding went on all right until down to 13·6 grains. The process then completely changed over to one of oxidation, and would appear to have completed oxidizing before reverting back to sulphiding. The result was that H_2S was not eliminated before the fifth or catch-box. In changing the series, it is best to be guided by the oxygen absorption. When the quantity of oxygen taken up by the purifiers permanently decreases, this is the time to change.

In the backward rotation system, the final box is, at each change, brought to the first place in the series. Taking four boxes as before, we should have the following series:

1, 2, 3, 4; 4, 1, 2, 3; 3, 4, 1, 2; 2, 3, 4, 1; 1, 2, 3, 4.

Thus a box originally the first in the series travels backwards towards the end of the series. We have not tried this method;

the other having with us been quite successful. A box gets well sulphided in the first position, and one would not think it is then in the best condition for taking out the final portions of the H_2S as is required of a box in the second and third positions. In the forward system, a catch-box is required to catch the foul gas already in the box on changing to the last position. Where there are only four boxes and no catch-box, this can be obviated by making the changes more frequent, so that H_2S never shows at the outlet of the third box, and, following out the backward method, making rapid changes until the second series of the forward method is arrived at—*e.g.:*

1, 2, 3, 4; 4, 1, 2, 3 (rapid); 3, 4, 1, 2 (rapid); 2, 3, 4, 1.

When the oxide is well spent in a box and requires to be taken out, this is indicated by the box becoming quickly fouled when in the first position, with the result that only partial revivification in the last two boxes has been effected when a change of series is required.

There are causes other than the material being spent which might bring about this result. Before emptying a box, therefore, judgment should be used as to whether the material is spent; and it is quite a good plan to take samples of the oxide for analysis. This can easily be done by inserting a sampler—such as the long augur used for sugar sampling—through one of the blow-off valves or plugs on the covers; the box being shut off temporarily. When it is found that the oxide is really pretty well spent, the box should be placed last in the series—that is, follow out the ordinary sequence—and the gas passed through it in this position for a couple of days. This will precipitate the sulphur to some extent, so that on opening-out oxidation is reduced and the risk of fires minimized. If the system is intelligently worked, outside revivification and mechanical disintegrators for breaking up the partially spent oxide become unnecessary.

It has been stated [see paper by Mr. Howard Mann, of Montreal, in the "JOURNAL" for Oct. 13, 1914] that a purifier would not clean up in the last position if operated as the first box for two or three weeks, and would only do so if operated as the first box for two or three days or so and then changed to the last. This is in contradiction to our whole system of working. The last box certainly does pick up any oxygen that may enter it, even though previously in the first position for five or six weeks.

There are many factors which influence the efficient working of oxide purifiers. First and foremost is the oxide itself—*i.e.*, its composition, physical state, size, and wetness. It should contain a high percentage of hydrated ferric oxide, and be in a fine state of subdivision.

As a mixing material, old oxide in the proportion of one of old to five of new is good, and much better than shavings, sawdust, or coke breeze, the former two of which are difficult to mix, and all of which depreciate the value of the spent material and increase the liability of fire spreading should one take place locally. When put in ready mixed, the oxide should contain just sufficient moisture to prevent it passing through the bottom grids. If too wet when put in, "rat holes" are formed on drying, through which the gas takes short cuts.

Chemical action in the purifiers is an exothermic one—heat being evolved. This heat should be conserved. If the oxide is too wet the heat is rendered latent by evaporation of the water, and the temperature, and consequently efficiency, of the oxide is reduced. Temperature plays an important part. Most oxides have their highest efficiency at about 80° Fahr. With some of us a temperature of 80° Fahr. at the purifiers would result in the gas passing through the station meter at an abnormal temperature, and be very misleading unless frequent observations of meter temperatures were made. A temperature of 65° Fahr. is one we try to work at. If the temperature falls much below 50° Fahr. the oxide becomes sluggish.

In our case the boxes are artificially heated by means of a coil of 2-inch steam-pipe passing round the bottom of the interior of the boxes. We recently introduced live steam into the inlet leading to the last box—the gas here being free from H_2S—with a view to seeing the effect on the sulphur compounds. Our investigations are still proceeding, sufficient tests not having yet been made to justify any conclusions being drawn. A large purifying area is also essential, in order that there will be sufficient time-contact between the gas and oxide. It is not sufficient to just pass the gas through the oxide; time must be allowed for chemical actions to be completed, especially revivification. The gas must be free from tar-fog before entering the purifiers; otherwise the oxide is made to act as a filter, with subsequent back-pressure troubles and the throwing out of boxes before the oxide is spent.

In some quarters the caking of oxide is somehow or other associated with revivification *in situ*. Our experience is that it is the first box in the series which cakes-up, as shown by increasing back-pressure; yet, as will be seen from the table of H_2S and O_2 absorption, little or no oxygen is taken up here. Prior to the introduction of vertical retorts, and also about the same time that toluol extraction by tar washing was being carried out, our tar extraction was very complete, and we had little or no trouble with caking oxide. The tar from verticals contains only from 1 to 2 per cent. of "free carbon," against about 20 per cent. in horizontals, and the removal of tar-fog becomes much more difficult.

The following analyses of samples of oxide taken from the top caking layer, half-way down, and from the bottom of a box which had been throwing 10 inches pressure, point to the conclusion that the light oils and tar-fog (possibly increased by tar washing) carried forward by the gas to the purifiers, together with moisture and heat of chemical action, play a big part in this caking effect.

Analyses of Samples of Spent Oxide.—Dry Basis.

—	Top Caking Portion.	Centre of Box.	Bottom of Box.
	Per Cent.	Per Cent.	Per Cent.
Sulphur	59·49	61·28	61·90
Tar, &c.	6·77	1·81	1·22
Ammonium sulphocyanide . . . (NH_4SCn)	4·63	1·72	0·13
Prussian blue ($Fe_4[Fe(Cn)_6]_3$) . .	4·72	5·23	6·21
Moisture in oxide as taken from box	5·38	1·92	1·42

The box had been on continuously for eleven months. The filtering action of the oxide is shown by the diminution of the tar content as we go down the box.

The decrease in ammonium sulphocyanide may be due to less being formed, or to the solvent action of the increasing water of formation in falling through the oxide. Possibly both causes are at work. The caked portion, 6 inches deep, was extremely hard, requiring picks to break through it; the remainder was quite loose and powdery. We are now taking steps to more effectively remove this tar-fog.

Tests for oxygen, as well as sulphuretted hydrogen, should be made at the inlet and outlet of the purifiers; and it is an advantage to make quantitative tests periodically—say once a week—to ascertain the work each box is performing.

The theoretical quantity of air to admit is two-and-a-half times the H_2S content by volume. If admitted on the vacuum side of the exhauster, the scrubbers take up some of the oxygen, and it is best to be guided by the oxygen content at the inlet of the purifiers. About 0·6 time the H_2S works well in practice, leaving only a trace in the outlet gas.

At many works elaborate arrangements of blowers, stepped cones, and air-pipes are in use for the purpose of putting into the gas a fixed proportion of air for revivification purposes, though on the same works it is probable that more than enough oxygen for this purpose is being "pulled" into the gas during the "draws" and through leaky lids.

If the oxide gets acid in character, the sulphuretted hydrogen converts it into iron pyrites, which does not revivify into activity. To prevent this, allowing a trace of ammonia to go forward with the scrubbed gas is sometimes advocated, though in ordinary scrubbed gas there are generally from two to three grains of ammonia per 100 cubic feet of gas, and this is sufficient with most oxides to prevent acidity. With gas thus slightly alkaline, ferric sulphide is produced, which revivifies readily. Further, any ferric sulphide which may have been oxidized to sulphate will be decomposed into ammonium sulphate and ferric hydroxide, which will be in a very active state for taking up sulphuretted hydrogen.

UPWARD OR DOWNWARD FLOW?

It is a decided advantage to work with downward flow—that is, inlets at the top and outlets at the bottom. When the gas enters at the bottom, the grids occupy one-half the area presenting itself to the gas, which means that the action on the other half area of oxide is doubled. Further, should caking take place, the water of formation from the material collects on this cake and assists in obstructing the free flow of gas. When the gas enters at the top, if there is caking at all it is spread over the whole area of the box, and the time elapsing before causing excessive pressure is correspondingly longer. It is then quite a simple matter to take off the covers and break up the cake without disturbing the rest of the oxide. In the case of upward flow, this would entail emptying the whole box.

Again, with the downward flow all the water runs freely away through the loose material underneath. It is the practice at some works to periodically reverse inlets to outlets and *vice versâ;* one object being to sulphide the oxide more uniformly. Our connections are not arranged to enable us to do this; and the analyses of the sulphur content of the oxide at different depths in the purifier do not show that any advantage in this direction would be gained. Hurdle grids are in advance of the ordinary kind. From 28 to 30 per cent. more oxide is got into a box, and it is held more loosely and of fairly even density throughout, with the result that there is more even sulphiding and less back-pressure thrown by the box. If the oxide be well packed at the walls of the box, there is no short-circuiting. On examining a box after twelve months' continuous work, no sign of short-circuiting could be seen. In filling up the box, sufficient room must be left between the oxide and the cover to allow for increase of bulk. In emptying a box with hurdles in use, care must be exercised. If the material has not caked the hurdles come away readily, and the oxide is easily shovelled out; but if caking has taken place, the use of a pick is necessary to break the cake, and there is a risk of one damaging the grids.

Taken all round, the time needed to empty and fill a box is about the same as with ordinary grids. It is a good plan to have the boxes elevated, with a mixing floor above. The oxide can then be stored ready mixed under cover, and is charged into the boxes by means of canvas shoots with the minimum of labour. When spent, it is also readily discharged. The rubber lute type of cover is now generally recognized as being the most advantageous. The covers may be made in sections, and the lifting gear made correspondingly lighter. There is also no danger of lutes blowing, and no corrosive action as between wind and water in the water-lute type. In working the rotation system, the interval between changing valves is sometimes so long that, when attempting to change, it is found that the valves have become very stiff. To prevent this, the spindles should be kept clean and well lubricated, and the valves run up periodically.

The sulphur content of the gas supplied to the town averages 7·6 grains per 100 cubic feet. This low figure led to the thought that some reduction in sulphur compounds other than H_2S took place in the purifiers, possibly due to the absorption of CS_2 by the large amount of free sulphur in the oxide. Gas was led from the inlet of the purifiers through two small purifiers containing entirely new oxide, and thus freed from H_2S. The gas was then tested for sulphur compounds. The result of the test showed 9·06 grains of sulphur per 100 cubic feet at the inlet of the purifiers proper, and 5·7 grains at the outlet. It is to be noted that this is the result of one test only, and would need confirming by a series of tests.

While on the subject of CS_2 the following reversible reaction may be noted as possibly having some bearing on the fact that gas may be quite clean at the works and yet show faint traces of H_2S in part of the district.

$$CS_2 + 2H_2O \rightleftharpoons CO_2 + 2H_2S$$

The action takes place rapidly at 212° Fahr. and moderately at temperatures above 77° Fahr. This also may explain how in a works such as ours, where even a trace of H_2S in the gas leaving the works is practically unknown, yet on analyzing the deposits in the service-pipes free S was found.

Before bringing these notes to a close, it might be of interest to state that since adopting the "forward rotation" system we have had no outside revivification; the oxide once put in the boxes not being removed until ready for sale. This is of special benefit during these times of labour scarcity, and financially it has meant that for the last two-and-a-half years our purification has been a source of profit to the department.

[The writer here wishes to express his sincere thanks to his chief (Mr. James Macleod, F.I.C.) for his kindness in allowing him to bring before the members the particulars contained in the paper, and for the encouragement received in its preparation.]

Northern Gas-Workers' Wages.—At a meeting of the Northern Executive Committee of the National Union of Gas and General Workers, held at Sunderland, the District Secretary reported that he had been in negotiation with the Sunderland, South Shields, and Tynemouth Gas Companies for an advance of wages. A settlement had been arrived at with the Sunderland and Tynemouth Companies for an additional war bonus of 1s. 6d. per week; and it was expected that an arrangement on similar lines would be effected with the South Shields Company.

A "Bad Gas" Resistance League.—With regard to the paragraph appearing in last week's "JOURNAL" [p. 376], in which it was stated that at a public meeting at Brentwood (Essex) the quality of the gas supplied by the Brentwood Gas Company had been severely criticized, it may be mentioned that the Engineer and Manager of the Company (Mr. H. D. Lumb) has addressed a letter to the local papers in which he points out that the statements there made were entirely *ex parte*. Mr. Lumb adds: "If I had been invited, I would have willingly attended, prepared to answer any question, and to remove any wrong impression. As it is, I can only say I totally and strongly disagree with all that was said and done on that occasion."

Redcar Gas Company.—The Redcar, Coatham, Marske, and Saltburn Gas Company's annual report states that the amount available for apportionment is £3803; and the Directors recommend a dividend of 4 per cent. on the original and "A" shares (making 8 per cent. for the year), and £2 16s. per cent. on the "B" and "C" shares (making £5 12s. per cent. for the year), free of income-tax. This will absorb £2368. The balance of £1435 is to be carried forward. The gas consumed shows a decrease of 9·8 per cent.; but this is regarded as being entirely attributable to the effect of the restricted lighting order. The price of gas was advanced on July 1 by 2d. per 1000 cubic feet; but on Jan. 1 this year, the charge was reduced to the figure at which it stood prior to the war. Some 30 per cent. of the Company's employees have joined His Majesty's forces; and allowances have been made to their dependants. There has been a shortage of labour; but the supply of gas has been well maintained.

Middlesbrough and the North Ormesby Gas-Works.—Since the amalgamation of North Ormesby with Middlesbrough about two years ago, the North Ormesby Gas-Works have not been used; and at a meeting of the Middlesbrough Gas and Electricity Committee last Tuesday, a letter was read from the Teesside Bridge and Engineering Company offering £127 10s. per annum, representing 7½ per cent. on their estimated value of the property, for the lease of the land, with the option of purchase. The Chairman (Mr. Calvert) said there was no prospect of the demand for gas increasing to call for the re-opening of the North Ormesby Gas-Works. It was decided not to sell; but a Sub-Committee were empowered to arrange for the best terms for a lease. The Chairman reported that in the first ten months of the financial year, the Middlesbrough gas undertaking had made more profit than in the previous twelve months. Probably next year would be as profitable as the present one. The year's surplus would, he thought, cover the cost of all extensions of mains which had this year to be met out of revenue.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Pitch for Gas Making.

SIR,—Some weeks ago it was suggested in your columns that pitch should be used for gas making. At the present time, when coal is difficult to obtain, and huge stocks of pitch are speedily accumulating all over the country, the suggestion was most opportune; and I am pleased to record my thanks to those who have already entered the experimental field and given us the benefit of their experience. The value of pitch in gas-making has up till now never been seriously investigated; but the lack of data at this juncture need not deter engineers from giving it a trial upon a practical scale.

In our case the use of pitch is quite feasible, and at the present time profitable. Acting upon the suggestions in the Technical Press, I immediately began to use an admixture of pitch with coal in our horizontal retorts; and at the same time I carried out in our experimental works a series of twelve tests with a view to ascertaining the comparative values of coal carbonized alone and coal admixed with 10 per cent. of moderately hard pitch. The coal used was a first-class Lanarkshire double nut, freshly worked, and quite dry. The pitch used was obtained from a 65 per cent. mixture of vertical retort tar and 35 per cent. of horizontal retort tar. It softened at 80° C.; "twisted" at 75° C.; and fused at 95° C.

The retort in the experimental works is of fire-clay, 21 inches by 15 inches by 8 ft. 6 in. long; and the remainder of the plant is in exact proportion. Oxide of iron is used for purification. The carbonizing temperature was exceptionally good; the 2-cwt. charges being burned off in 2 hrs. 50 mins.; and every precaution was taken to obtain really reliable results.

To secure a thorough admixture of pitch and coal, it is best to break the pitch into small pieces. Even the pitch dust can be employed with advantage.

The following are the results of our tests:

Average Results of Tests per Ton of Material Employed.	Coal 2240 lbs.	Coal 2015 lbs. Pitch 225 lbs.
Gas made per ton (corrected), cubic feet	12,103	11,841
Illuminating power (No. 2 "Metropolitan" burner)	15·70	15·83
Calorific value, gross	574·1	612·5
Carbonic acid, per cent.	1·95	2·03
Coke, pounds	1,400	1,358
Tar, gallons	7·91	8·75
,, specific gravity	1·225	1·220
Liquor, gallons	15·4	16·0
,, strength, degrees Twaddel	2½	2½

It appears, therefore, that a ton of the pitch used in these experiments yielded 9488 cubic feet of gas. Compared with the all-coal results, the admixture of coal and pitch yielded rather less coke per ton of material; rather more tar, highly viscous, and holding more water in suspension; about the same quantity of liquor; and 262 cubic feet less gas of higher calorific value. The mixed coke is of excellent appearance, and burns well in an ordinary domestic hearth. It was noticed that the carbon deposited upon the retort differed from that usually found.

The above results did not exceed my expectations; but I considered them sufficiently alluring to continue the carbonization of pitch upon a working scale.

At first a 10 per cent. admixture was tried; but, owing to the pusher-heads of the hydraulic charging machines in the horizontal retorts becoming quickly clogged with melted pitch, this quantity was reduced to 5 per cent.; and during the past three weeks this proportion has been constantly admixed with the coal with satisfactory results.

Up till now we have not had a single choked ascension pipe; neither have we had trouble with pitch in the hydraulic mains.

We have also tried a 5 per cent. admixture of pitch in a bed of four vertical retorts (Woodall-Duckham); but after fourteen days continuous use, we had to abandon the experiment, owing to the coal and pitch coking and bridging-over solid just below the junction of the mouthpiece and retort, and also at the gas off-take pipe. We also noticed that the pitch was inclined to soften immediately above the coal feed-valve—thus binding the coal, and preventing a free discharge through the valve to the auxiliary coal feed-hopper.

When pitch is used in vertical retorts, it is necessary to completely empty the overhead storage hoppers when retorts are put off for scurfing, or stop using pitch a day or two in advance of the scurfing process.

As a result of experience gained, we are now trying a 5 per cent. admixture of pitch in our two vertical retort benches on alternate days—*i.e.*, a mixture of coal and pitch one day and coal alone the following day. This may prevent premature coking at the top of the retort, and will be equal to an admixture of 2½ per cent. per day only. Ultimately the quantity may be increased, as our experience extends.

I have no hesitation in advising the use of pitch for gas making—even the smallest works can safely do so—and with hand-charging 10 per cent. judiciously admixed with coal should give no trouble.

As this subject is one of much interest, I hope engineers generally will publish the results of their experiments for the mutual benefit of the industry.

ALEX. YUILL, Engineer and Manager,
Dundee Gas Commission.

Dundee, Feb. 15, 1916.

Showroom Reform.

SIR,—Adverting to the article by Mr. Cyril Davis in your issue of Feb. 8,

I quite agree with him as to what an attendant should be; but he loses sight of the fact (but I think he knows) that it is not altogether the fault of the attendant that he does not attain a higher standard of dignity and efficiency. This, I think, is due to the undertaking not giving him the position that he should have. By uplifting, instead of crushing him, let the man feel he has a position, and give him a chance to assume the dignity and authority necessary to carry on efficient salesmanship.

To quote "Sheldon," it is unfair to give a man responsibility without authority; also to expect him to dress and live-up to a higher standard than his income will allow, although many are struggling to do so at the present time. This is undoubtedly a question for the heads of gas undertakings, who should take their attendants a little more into their confidence, and discuss the position, so that the desired result be obtained.

Further, I would ask, Is a salesman properly described, and are the general public expected to look up to the word "attendant," when referred to him by a third party?, as "Oh yes, Madam, you had better see our showroom attendant"—"the official in charge of various conveniences is so described."

FAIRPLAY.

Feb. 17, 1916.

Sir,—I quite agree with your correspondent, "Showroom Attendant," that there is little in Mr. Cyril Davis's admirable article in your issue of Feb. 8 to which exception can be taken. His hints as to personal appearance, cleanliness, and dress are, of course, perfectly sound, but one would think so obvious as to be almost superfluous, and apply equally to all who are brought into contact with the public in the interests of their employers.

Of much more importance is it, I venture to think, that he should (as Mr. Davis suggests) make himself acquainted with everything that he possibly can connected with the gas undertaking. He should be something more than a mere salesman. He should be competent to advise as to the economical consumption of gas, to which end a knowledge of gas manufacture, pressure, and tested results of various burners will help him. If a consumer gave him sufficient data to form an idea of the cubical space of a room and the window area, he should be able to advise the size of fire necessary to warm it. But is he encouraged in this connection? No; should he do so, he is presumed to have encroached on the inspector's province, and finds later a different fire advised, and the consumer afforded the further information that the showroom attendant did not know what he was talking about, and that only he, the inspector (probably recently promoted from the fitter's bench), was competent to advise.

And at what showroom is an attendant encouraged, or indeed permitted, to write letters to a consumer? No, Sir, he is too often regarded as only a shopman, incapable of writing a letter, and lacking the technical knowledge to advise a consumer. The erstwhile gas-fitter on his promotion to an assistant inspectorship—notwithstanding his usually narrow knowledge of the gas industry generally, and not too liberal educational equipment—can at once look forward to a far more generous scale of remuneration than any showroom attendant.

If Mr. Cyril Davis's article, and your own sympathetic editorial remarks, induce managers and others to encourage initiative and recognize more liberally our status, you will have earned the gratitude of all showroom attendants.

ANOTHER SHOWROOM ATTENDANT.

Feb. 18, 1916.

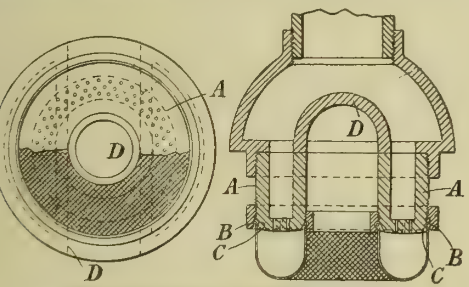
REGISTER OF PATENTS.

Obtaining Illumination by Incandescent Mantles.

CARS, B., of Highbury, and PALMER, W. D., of Muswell Hill.

No. 1005; Jan. 21, 1915.

This invention has for its object "to obtain an improved burner for use with annular or ring-shaped double-walled mantles."



Cars and Palmer's Mantle Burner.

An underside view of a high-pressure burner and mantle constructed according to the invention (the mantle being partly removed) is given; also a vertical section of it.

The gas distributing chamber of the burner is of hemispherical shape, and serves the purpose of preheating the mixture which flows into it from the tube above. Carried by the chamber and opening into it is an annular double-walled nozzle A formed like a hollow ring tipped with refractory material and perforated with fine holes through which the mixture issues. The annular or ring-shaped double-walled mantle, "of known construction," fits on to the annular nozzle, and is held in position by the inner wall being carried by an exteriorly threaded ring of refractory material which screws upon the threaded end of the inner wall of the nozzle as shown in the section. The outer wall of the mantle is furnished at its top end with a bead or thickening B, and the periphery of the nozzle with a groove C, while above the groove the nozzle is threaded so as to screw on to an interiorly threaded ring of refractory material so arranged that in its lowermost position it presses the bead of the outer wall of the mantle into the groove of the nozzle, thus clamping the outer wall of the mantle securely in position.

In order to furnish a central draught for the products of combustion from the flame, a transverse outlet D, communicating with the space between the inner walls of the nozzle and the outer air, is provided.

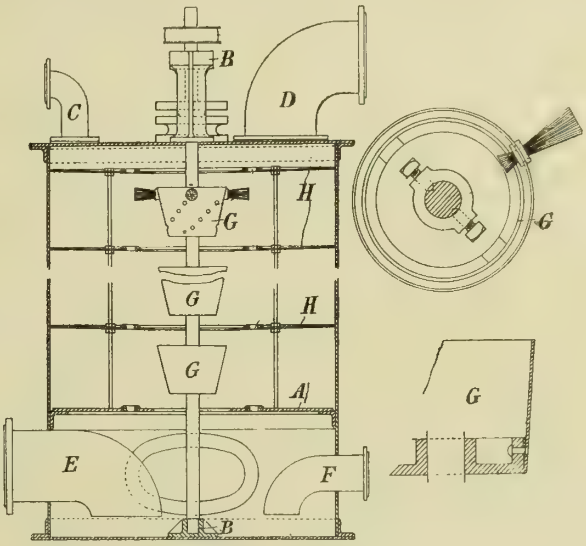
The ring of flame issuing from the perforations in the burner ring, "which develops intense heat," is said to be more evenly distributed over the surface of the mantle than heretofore, rendering it highly incandescent and producing "from one mantle a very high candle power for a given consumption of gas."

Scrubbing Gas.

MACLAURIN, R., of Stirling.

No. 1380; Jan. 28, 1915.

In a gas-scrubber in accordance with this invention a vertical casing or tank is provided with means for supplying a scrubbing liquid at the top of the casing and gas to be scrubbed at the bottom, a plurality of horizontally disposed annular dish-shaped plates or partitions, and a series of vessels disposed in vertical succession therein and adapted to be rapidly horizontally rotated in unison—each vessel being provided with brushes having short flaring bristles communicating with the interior of the vessel. The arrangement is such that the scrubbing liquid thrown against the sides of the vessels by centrifugal action comes in contact with the inner ends of the bristles, travels along the bristles to the outside of the vessel, and is thrown from the bristles as a fine spray or rain.



Maclaurin's Gas-Scrubber.

A vertical central section is shown through apparatus embodying the invention; also enlarged detail views of one of the vessels.

The casing or tank is preferably circular in section, having a bottom plate, an intermediate false bottom or horizontal partition A, and a top plate, all secured together. Above the top plate and on the bottom plate are arranged bearings B, in which is mounted (so as to be rotatable) a shaft driven from a pulley above, or by any other suitable mechanism. At the upper end of the casing is an inlet conduit C for the washing or scrubbing liquid and an outlet conduit D for the gas. At the bottom of the casing is an inlet conduit E for the gas and an outlet F for the washing or scrubbing liquid. Arranged in vertical succession along the shaft are vessels G that rotate each in a horizontal plane. Also arranged in vertical succession within the casing is a series of horizontally disposed annular dish-shaped plates H provided with apertures to facilitate the passage of the gas. The plates H and vessels G are arranged alternately. Each vessel G is open at the top, and is provided at the bottom with an upstanding annular flange surrounding the central opening through which the shaft passes; and each vessel is secured in position on the shaft by set-screws or bolts. The sides of the vessels are provided with brushes (as shown) with projecting bristles—the whole having a flaring or conical shape. The holes shown n the uppermost vessel are provided for the purpose of inserting the sockets of the brushes (the brushes themselves being omitted for clearness of illustration). No brushes are shown mounted in the other vessels, but each vessel is so provided.

The operation of the apparatus is as follows: The liquid entering at C flows down upon the uppermost plate H. Owing to its shape, the liquid flows towards the centre, and is delivered into the uppermost vessel G. As this vessel is rapidly rotated, liquid falling into it is thrown towards the sides by centrifugal force, and comes in contact with the inner ends of the brushes, passes along the bristles, and is thrown from them as a fine spray in every direction owing to the flaring shape of the brushes and their disposition around the vessel. The rain of liquid thus formed is caused to impact violently against the wall of the casing and falls on to the second plate H of the series, flowing towards its centre and thence into the second vessel. This operation is repeated with each plate H and vessel G until the bottom of the casing is reached, where the liquid is drawn off through the outlet F. In the meantime the gas to be scrubbed has entered through the inlet E, and rising up comes into contact with the lowermost vessel G, and, striking the brushes and revolving parts, receives a swirling motion and is thrown against the shell of the casing—being brought into intimate contact with the washing liquid as it impacts violently upon the casing. The gas meets each vessel and its projecting brushes in turn, and "is thereby given a long travel through a mist of liquid, so that by the time it has reached the top of the apparatus it has parted with its deleterious matter."

Controlling the Charging and Discharging of Gas-Retorts.

Carpenter, H. A., and Warner, A. W., of Sewickley, and the Riter-Conley Manufacturing Company, of New Jersey, U.S.A.

No. 5266; April 7, 1915.

The primary object of this invention is to provide for so controlling the retort charging or discharging operations that they cannot ensue unless the mechanism immediately involved is properly positioned relative to the retort. For the charging operation, the desired result is accomplished by rendering the charging means inoperative until it is in proper position to co-operate with the retort; while for the discharging operation, that it cannot take place until the receiver is in proper position relative to the retort outlet to receive the coke. In cases where the entering fresh charge (or charge-carrying tool) is utilized for discharging the coked product of the last preceding charge, the arrangement is such that the fresh charge (or the device carrying the charge) cannot be entered in the retort until the coke-receiver is in position at the retort outlet.

The invention contemplates broadly the proper positioning of means adapted to co-operate with a retort at either end during a charging or discharging operation—regardless of any accomplishment at the other end. Thus provision is had whereby the charging of the retort is prevented until the charging means is in proper position relative to the retort inlet, and without taking into account what may transpire at the outlet. And, conversely, it contemplates properly positioning a coke-receiver relative to the retort-outlet without regard to any operation that may take place at the inlet, except in such forms of apparatus as those wherein the removal of the coke is accomplished only by force applied through the retort inlet.

In the preferred adaptation of the invention, "the operations of the retort charging and discharging instrumentalities are controlled electrically; it being necessary for such instrumentalities to be properly positioned relative to the retort in order to close interruptions in an electric circuit, the closing of which is prerequisite to energizing the mechanisms involved in the charging and discharging operations." Electrical control is, however, not essential, since it could be substituted by mechanical or fluid pressure control, or a combination of two or more such forms of control, without departing from the spirit of the invention.

A further object is to constitute the retort doors "auxiliary controlling instrumentalities," whereby one door (or both doors) is necessarily in open position before either the charging operation or the discharging operation, or both, can ensue.

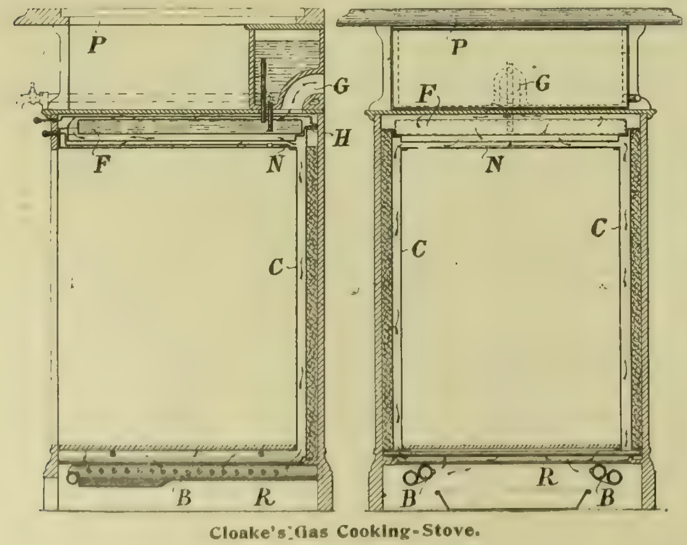
A series of detail drawings is appended to the patent specification. One is a diagrammatic view of apparatus wherein the operation of the retort-charging "instrumentalities" is dependent upon properly positioning the same relative to the retort inlet. There is a similar diagrammatic view wherein the retort-discharging means are rendered operative only by properly positioning a coke-receiver—the latter when in position serving to close an interruption in the controlling circuit whereby the retort-discharging means are rendered operative. There is a third similar diagrammatic view wherein the retort charging and discharging means are inoperative until the means and also the coke-receiver are properly positioned relative to the retort. The fourth is a detail view illustrating one of the interruptions in the controlling circuit which is opened and closed by the retort door.

Gas Cooking-Stoves.

Cloake, A. G., of Holborn Viaduct, E.C.

No. 8013; May 31, 1915.

The object of this invention is to provide a construction of oven which is loose and can be readily introduced inside the casing of such cookers as are now furnished with ovens open internally to the heat from the burners, so as to form an oven which is heated externally instead of internally.



Cloake's Gas Cooking-Stove.

A central sectional side elevation and a sectional front view of the suggested arrangement are shown.

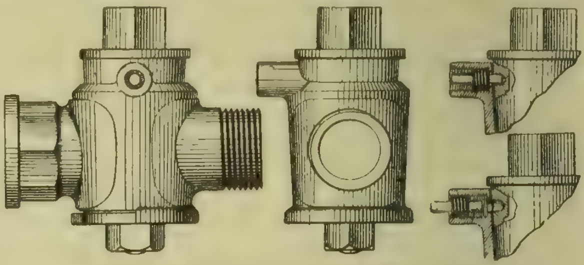
The cooker comprises the usual outside casing with a door in front (not shown). Into the space within the casing is introduced a removable rectangular box C, preferably with an open front adapted to be closed by the door of the casing. The box is supported on rods extending across the casing just above the burners B. Sufficient space is left between the box and the sides and the back of the casing for the heat from the burners to pass. Above the box is a plate having apertures for the passage of heat to the underside of the boiler F above the plate. Normally, the heat passes beneath the boiler towards the front of the cooker and returns on the upper side of the boiler to the flue G. An alternative course for the combustion products from the burners is provided by the damper H operated from the front of the stove by a rod. When the damper is open there is no draught around the boiler, and the fumes escape direct to the flue. The boiler has a circulating connection with the water-tank L. N is a ventilating damper for the oven, accessible by a rod from the front of the cooker. P is the usual hot-plate beneath which are the usual burners for boiling, grilling, &c. (not shown). An additional space for grilling is provided at R beneath the oven floor.

Gas-Main Cocks.

Evered and Co., Limited, of Smethwick, and Pizey, J. C., of Tottenham.

No. 8974; June 18, 1915.

This invention has reference to gas-cocks provided with locking screw-pins to secure the plug in the closed position and prevent the opening of the cock until it has been unlocked by the proper key.



Pizey's (Evered and Co.) Gas-Main Cock.

The internally screwed tubular lug for the reception of the locking screw-pin is made (as shown) on the tubular body or casing of the cock in which the rotary plug is fitted above the "sealing" part, which ensures a gas-tight fit between the plug and the body or casing. In the lug is fitted the locking screw-pin the inner end of which, when the plug is turned off, can, by screwing, be made to engage with a hole in the plug and secure it against rotation until the screw-pin is withdrawn. The locking screw-pin is made with longitudinal grooves or channels for the reception of a projecting pin, or pins, or fingers, on the barrel of the key. The tubular lug is so constructed that the complete withdrawal of the locking screw-pin is rendered impossible; the inwardly turned flange of the lug having notches in it to permit of the projecting pins or fingers on the key passing through it.

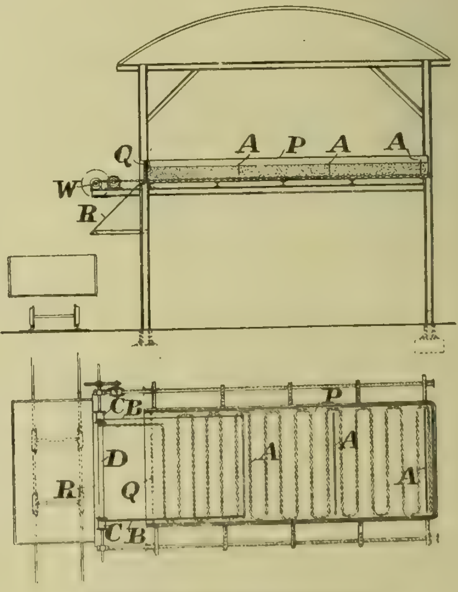
The illustration represents in side and end elevation a gas-main cock containing the improvements constituting the invention; also a portion of the cock partly in end elevation and partly in section with the locking screw-pin in the fastening position and in its withdrawn or unfastening position.

Disintegrating and Loading Hard Pitch.

Carl Still (Firm of), of Recklinghausen, Germany.

No. 13,546; Sept. 23, 1915. Convention date, Oct. 2, 1914.

This invention is intended "to simplify essentially and cheapen the work of disintegrating and loading hard pitch or similar material which has been run into large open cooling pans or walled pits and has set therein." Heretofore the method employed not only entails considerable costs, but also has an injurious effect on the health of the workers. By the present invention all disadvantages inherent in the procedure heretofore employed are obviated, and the work of disintegrating and loading the pitch is performed solely by mechanical means in a simple and rapid manner.



Carl Still's Pitch Disintegrator.

A vertical longitudinal section through a pitch pan and a part of the cooling shed employed is shown; also a plan.

The cooling pan P, of oblong rectangular shape supported on transverse and longitudinal beams, is arranged in the usual manner so that the one end Q is removable. At the same end of the pan a shoot R is fitted; and at a suitable distance from the end of the pan is journalled a shaft W, running in bearings fitted to the extended ends of the longitudinal beams. The shaft is driven by a motor and gearing. On the shaft are fitted two narrow drums C, and between them a long drum D extending across the whole breadth of the pan. Before the pan is filled with pitch, a link-chain of sufficient length is laid along the bottom of the pan (with its one end hanging out at the removable wall Q) in a waved or serpentine line, so that practically the whole area of the bottom of the pan is covered by it. Partitions A, extending almost across the whole breadth of the pan, are inserted into the pan parallel to the wall Q, so that after the pitch has been run in and set to a rigid layer, the partitions, as also the chain, are completely embedded in it. After the pitch has thoroughly set, the wall Q is first removed and the free end of the chain is coupled to the drum D on the shaft W. When the shaft is driven and the chain slowly wound up on the drum, "it will tear the whole layer of pitch in the pan into a large number of pieces which represent a heap of broken pitch ready for shipment."

For facilitating the removal of the broken pieces from the pan and their discharge into the transport means the partitions A may be utilized as scrapers, being drawn along the bottom of the pan by ropes B winding on the drums C, so that they will direct the pitch down the shoot R into the trucks run beneath.

The employment of a beam or scraper drawn forward by ropes was described in patent No. 7364 of 1915 in connection with the removal and loading of a mass of coke from a quenching bench. But the patentees claim that the present invention not only affords the advantage of considerable simplification and cheapening of the work of converting the pitch into a transportable form, but also of a considerable increase in the value of the final product.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Feb. 16.]

Nos. 1770—2132.

Adams, C. H.—"Boring and tapping machines." No. 1892.
Becket, W. H.—"Cooking-stoves." No. 2004.
Cannon Iron Foundries.—"Atmospheric burners." No. 1968.
Chambers, E. V.—"Removal of water from water-gas tar, &c." No. 2102.
Clark, J. H.—"Incandescent gas-lamps." No. 1993.
Falk, G.—"Incandescent burners." No. 1806.
Falk, Stadelmann, and Co.—See Falk. No. 1806.
Furber, J.—"Preventing bursting of water-pipes." No. 1834.
Hammond, T. C.—See Chambers. No. 2102.
Hawthorne, H. S.—See Cannon Iron Foundries. No. 1968.
Helps, G.—"Gas cookers." No. 1889.
Hird, H. P.—See Chambers. No. 2102.
Lachmann, W.—"Separating gases." No. 2005.
Richardson, C. K.—See Chambers. No. 2102.
Riter Conley Manufacturing Company.—"Conveying charges of material from one level to another." No. 1928.
Stimson, E. F.—"Taps or cocks." No. 2007.
White, A. E.—See *Riter Conley Manufacturing Company*. No. 1928.

PARLIAMENTARY INTELLIGENCE.

OPENING OF THE SESSION.

The Sixth Session of the First Parliament of the present King was opened on Tuesday of last week, when the Lord Chancellor delivered His Majesty's Speech to both Houses of Parliament. The Chairman of Ways and Means reported that he had conferred with the Chairman of Committees of the House of Lords (the Earl of Donoughmore) for the purpose of determining in which House the respective Private Bills should be first considered; and they had decided that the following Bills should originate in the House of Lords:

> Aberdare and Aberaman Gas; Burnley Corporation Water; Colchester Gas; Ferndale Gas; Hornsey Gas; Imperial Continental Gas Association; Newcastle-upon-Tyne and Gateshead Gas; Yeadon Water.

The following Bills are accordingly allocated to the Commons:

> Beighton and District Gas; Folkestone Gas; Northwich Urban District Council Gas; Plymouth and Stonehouse Gas; South Metropolitan Gas; Tynemouth Corporation Water; Uxbridge Gas; Wakefield Corporation Water.

All the Lords Bills have been read the first time, and, with the exception of Burnley, have been referred to the Examiners; and the Commons Bills have been read the first time and ordered to be read a second time.

Daylight Saving.

Replying last Thursday to Mr. Peto, who asked whether, with a view to saving electricity, gas, and oil, it was intended to propose legislation on the lines of the late Mr. Willett's Daylight Saving Bill, Mr. Asquith said he was afraid he could not introduce legislation on such a contentious subject.

Lighting Restrictions.

Mr. H. Samuel, in the House of Commons last week, stated that lighting restrictions were of great utility to the locality which adopted them. Within a day or two of the last air raid, a conference was held at the Home Office of officers of that Department and of the War Office and Admiralty. Within a few days an order was made extending the lighting restrictions to the whole of England, with the exception of a few outlying districts, and steps were being taken to extend them to Scotland.

Petitions Against Private Bills.

Petitions have been deposited against the following Bills:

Beighton and District Gas, by the Rotherham Rural District Council.
Folkestone Gas, by the Folkestone Corporation, and the Sandgate and Cheriton Urban District Councils.
Northwich Gas, by the Cheshire Lines Committee.
Plymouth and Stonehouse Gas, by the Great Western and London and South Western Railway Companies.
South Metropolitan Gas, by the London County Council.
Tynemouth Corporation Water, by the Ashington Coal Company, Morpeth Corporation, National Pawnbrokers' Association of Great Britain and Ireland and North and South Shields and District Pawnbrokers' Protection Association, and the Ashington, Bedlingtonshire, Blyth, Cramlington, Newbiggin-by-the-Sea, Seaton Delaval, Whitley and Monkseaton Urban District Councils.
Uxbridge Gas, by the Slough and Eton District Councils.

LEGAL INTELLIGENCE.

Water Used for Laundry Purposes.

At the Aldershot Police Court, some astonishing statements were made in connection with water charges and the earnings of some who do washing for the troops, in a case in which Ethel Broadwood was summoned by the Aldershot Gas, Water, and District Lighting Company for using water other than for domestic purposes. It was pointed out that a test case, in which the facts were practically the same, had already been decided in favour of the Company;[*] and, after a lengthy hearing, an inclusive fine of 30s. was imposed. It was stated that, apart from the contractors who did the work in bulk, quite a large number of the wives and widows of soldiers, as well as others, were allowed to undertake troop washing in their own houses in the town. The enormous increase in the consumption of water since the outbreak of war had, however, rendered it necessary that the Company should have absolutely under their control the water supply of the town; and an arrangement had been come to with the military authorities by which there was handed to the Company a weekly list of the women undertaking troop washing, and the amount of work done by each. In the case of the widow or wife of a soldier, the Company allowed her to wash for forty men without making any charge for water, and beyond this one-third of a penny per week was to be paid for every man washed for. If they paid at the Company's office within seven days of demand, they were allowed a rebate of 50 per cent. off the amount charged. Defendant, who was the widow of a soldier, had not conformed to this arrangement; and when she was in arrears to the extent of £5 5s. 10d., the agreement, so far as she was concerned, was cancelled. The landlord paid the ordinary water-rate. One of the Company's inspectors gave evidence that the military list received on the 3rd inst. showed defendant was washing for 335 soldiers. About a hundred women were doing troop washing. Defendant, giving evidence, was asked why she had not paid the money, and replied that she fell into arrears and was not allowed a rebate, and she could not afford to pay the full amount weekly. One week the amount she actually paid came to 26s. For the Company, it was pointed out that this amount would represent 936 soldiers washed for.

Application Regarding a Mantle Seizure.

Sitting in the King's Bench Division of the High Court of Justice last Tuesday, Mr. Justice Atkin heard an application to set aside three judgments, by Mr. B. Frank, of Amsterdam. The matter had reference to the seizure by the Customs of certain incandescent gas-mantles, of which he was the owner. Mr. A. W. Elkin stated that the mantles were made in Holland, and were seized in London after having been shipped from Rotterdam. After judgment had been signed on Dec. 17, in default of claim to the goods being entered, Mr. Frank applied to the King's Remembrancer to set aside the judgments; but it appeared that the King's Remembrancer had no jurisdiction to set aside judgments of this character, which had been signed on a writ of appraisement. Mr. Frank now asked that the judgments should be set aside to enable him to file his claim. After some discussion, it was arranged that the applicant should have leave to enter his claim to the goods; the judgments being set aside for this purpose.

A Polluted Water Supply.

An action, the hearing of which had extended over three days, before Mr. Justice Horridge, at the Derbyshire Assizes, terminated on Saturday in a verdict being given for £250 damages against the Blackwell Rural District Council. The claim was brought by Ann Truswell, a widow, of South Normanton; the Jury finding that her husband's death was caused by the presence of typhus bacillus in defendants' water supply. The presence of the bacillus they held to have been due to the negligence of the defendants by leaving in a bye-pass unprotected at its open end, which should have been closed at both ends. The bye-pass bore the collar joint through a sand hole, in which sewage matter entered the main from a fracture in the adjoining sewer.

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[*] See "Journal," Vol. CXXVIII., p. 141.

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

The Ordinary Meeting of the Proprietors was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. W. Graham Bradshaw in the chair.

The Secretary (Mr. F. J. Bradfield) read the notice calling the meeting; and the Directors' report and the statement of accounts were taken as read.

A Satisfactory Result in Face of Many Difficulties.

The Chairman, in moving—"That the report and accounts be received, adopted, and entered on the minutes," said: Gentlemen, the accounts deal with the third half year passed under war conditions; and the shareholders are to be congratulated that they give such satisfactory results. The difficulties to be surmounted have not been few or slight; and they are by no means past. But so far they have been met and overcome successfully; and, from that fact, we may gather hope and courage for the future. It is, I think, a matter for gratification that, with only a moderate rise of 4d. per 1000 cubic feet in the price of gas, we have been enabled to earn our full dividend, and carry forward an increased balance of undivided profit to the current half year, and that this result has been achieved in spite of the higher cost of coal and oil and of nearly all the materials we use in our business, of higher freight charges, of a diminishing staff, and of higher wages. You will readily understand that the main cause of anxiety at all times is our supply of coals. First there is the purchase in the North; and then they have to be brought to our works in London. In both these matters, our difficulties since the war began have been great. The large number of colliers who joined His Majesty's forces reduced the output of coal, caused a large rise in prices, and rendered it doubtful whether there would be enough to go round. This difficulty was partly met by the institution in May last of the licensing system for the restriction of exports.

NEW COAL CONTRACT PRICES—COST OF SEA TRANSPORT.

So far as we are concerned, the collieries from whom we buy our coals, and with whom we have dealt for many years, have treated us well. Our ships have been loaded promptly; and our supplies have been well maintained. You will be glad to know that, although our existing contracts have still some months to run, we have already arranged for all our usual supplies for more than twelve months ahead. The prices have not yet been fixed in all cases; but we have actually contracted for a substantial quantity at a price considerably less than the limit fixed by the Price of Coal (Limitation) Act, 1915, which was passed last July. That is a reassuring feature of the position. But when we have bought our coals in the North, we have to bring them to our works in London. I have on more than one occasion pointed out to you the very large saving which has been effected by the possession of our own ships. Freight and shipping charges, although they have cost us—owing to restrictions in the North Sea, higher wages, and more expensive bunker coals—more than double what they were ten years ago, 5½d. a ton more than in the last half year, and 1s. 0½d. more than twelve months ago, are yet 10s. a ton less than current market rates. You will not wonder that our Engineer wrote to me recently: "To me our ships are one of the joys of my life." I am glad they are; for it was his enterprise and perseverance which led to our acquiring them now some fifteen years ago.

INSURANCE AGAINST AIRCRAFT RISKS.

It will, I think, tend to make you comfortable to know that we have fully insured our works against aircraft risks under the Government insurance scheme. The insurance does not, of course, cover the loss of business which would result if the works were severely damaged; but it does ensure that the loss would be confined within strict limits, and would be only of a temporary character.

HIGHER PRICE OF GAS AND INCREASED SALES.

I mentioned last August that we had been compelled to raise the price of gas by 4d. per 1000 cubic feet—*i.e.*, from 2s. 4d. to 2s. 8d. It is interesting to see that the Stepney Borough Council Electricity Department have decided to increase their charges for electricity by 15 per cent., which is about the same rate as our increase. It is satisfactory to note that, in spite of the higher price, our sales of gas increased by nearly 25 million cubic feet, or 1½ per cent., of which increase 10 millions came from ordinary meters, and 21 millions came from prepayment meters; the difference of 6 millions being due to the decrease on the public lighting. The improvement in the ordinary consumption was largely owing to the increased trade consumption, and also to the number of stoves and fires fitted. During the half year, 1311 additional stoves were fitted to ordinary meters, and 1768 to prepayment meters. It is probable a part at any rate of these increases is due to abnormal activities created by the war; and therefore they may not be maintained. But it must be borne in mind that the earlier closing of shops and the restrictions on public houses have considerably reduced their consumption of gas; and this part of our trade will probably recover at the end of the war. I should like to repeat and emphasize what has so often been pointed out, that coal burnt in an open grate is consumed in the most extravagant way possible, because all the bye-products, such as ammonia and tar, which are of such vast importance to the country at the present time, as being the materials from which high explosives are manufactured, are thereby lost. Anyone therefore who uses gas or coke to warm his house, or cook his food, or drive his engine, is doing a patriotic service and deserves well of his country.

PROJECTED TAR DISTILLATION.

The mention of tar leads me to explain that we contemplate a considerable modification in dealing with it. Hitherto, we have sold our tar to tar distillers at a price based on the value of its constituent elements; and the results have not been unsatisfactory. But now the low price of pitch, caused by high freights and the partial loss of the markets of Northern Europe, and the high prices of some of the distillates of tar, are leading us to the conclusion that we can get even a better return by undertaking some of the processes of manufacture ourselves. I may mention here that the amount of tar made per ton of coals last half year is the highest on record, and is doubtless due to the recovery of an extra amount of toluol from the gas. I wish, however, to point out that, although the gas companies are rendering valuable aid to the Government by furnishing them with toluol and benzol, and by manufacturing munitions, they are not deriving much profit from doing so. In our case, in the half year under review, only £744 has been received from toluol, and having regard to the additional expense incurred in the extraction, and the necessary outlay on plant, very little of this can be considered as profit. Moreover, the price obtained for the tar (including the amount received for toluol) has been exceeded by tar only, without the extra toluol, five times during the past eight half years. I am sure, however, that you will agree that no right-minded person wishes to make a profit out of the necessities of his country.

MUNITIONS WORK.

You will be glad to know that all our plant which is not required on absolutely indispensable repairs is engaged night and day in munition work, and that one of our Assistant District Engineers, Mr. F. L. Hart, has recently been appointed to succeed our Mr. G. M. Gill as District Manager under the Metropolitan Munitions Committee, and is doing invaluable work in that position.

FINANCIAL RESULTS.

I will now call your attention to the principal variations in the figures of the accounts which are before you. The item in the capital account for freehold land was in respect of the purchase of a portion of our Wapping works which we held on lease. We have been waiting for many years for the opportunity of buying the freehold; and it was of great importance to obtain it, otherwise we should not have expended capital in this way at this time. I have already explained the other items of expenditure on capital account. The expenditure on revenue account amounts to £249,898, which is £20,000 more than it was in the corresponding period of last year. This increased expenditure may be divided in round figures under the following heads: Manufacture of gas was £16,000 more, distribution of gas cost £2000 more, expenditure under the head of management £1000 more, and war allowances to employees £2400 more. These several figures aggregate £21,400. But there was a saving in the profit-sharing bonus of £1400, which makes the net increase £20,000. The £16,000 extra cost of manufacture was made up of £10,707 the increased cost of coals, of £4290 for oil, and £1000 for wages. Coals carbonized cost 1s. 10⅓d. per ton more than last half year, and 1s. 7¾d. per ton more than in the last half of 1914. But these increases do not represent the full measure of the rise in price of coals contracted for last year, because a part of the coals used were bought under previous contracts at a lower price. In the current half year, the cost of coal will again be considerably higher. The higher cost of oil is due to increased prices; and I fear we must anticipate a further increase in price when next we enter the market. The increase in carbonizing wages is due to the war bonus. Distribution charges were more by £1880 on account of the war bonus, the larger amount of work which had to be done, and the higher cost of materials. Rates are more by £657, owing to increased poundage. The increase in management charges is due to the cost of the quinquennial assessment and to the aircraft insurance. There is an item on this side of the account which has not appeared before. In previous half years, it has been included in the salaries and wages of the different departments. Allowances to employees on active service cost us £2460. I am on safe ground when I say that not one of us grudges in the smallest degree these allowances to the brave men who have offered themselves for the protection of their country. The least we can do is to keep their minds at rest that the loved ones whom they left behind are being adequately provided for. The war bonus, included under other heads in the accounts, cost the Company in the half year no less than £8641, so that allowances and extra wages and salaries totalled over £11,000. In the same period last year the amount was only £1469. On the other side of the account, we sold nearly 25 million cubic feet more gas, and charged 2s. 8d. per 1000 cubic feet, instead of 2s. 4d. Hence we realized more from gas sold by £28,312. Residuals yielded more than ever before in the history of the Company—producing £18,376 over last year's good results. Of this sum, coke produced more by £14,229; tar, more by £986; and sulphate, more by £3221. It is noteworthy that the average price obtained per ton of coke, which was 17s. 6d., is the highest ever realized by the Company; the previous best being 15s. 7d. in the first half year of 1913. Altogether, the receipts on revenue account were more than in the corresponding half of 1914 by £46,980, and our net profit is £72,760, as against £46,208—an increase of £26,552. In the second half of 1914, our profit fell short of the dividend and interest by £18,294; but in the same period of 1915, we have earned our full statutory dividend and interest, and have a surplus of £13,527. At the commencement of the half year, we brought forward a balance of undivided profit amounting to £65,623; and we shall carry forward £79,151 to the current year. This balance of profit is by no means large, in view of the uncertainty of the times. The cost of coal and oil will certainly be heavier in the present half year, and still greater in the following half year; while it is improbable that the price of residual products will materially improve. Our capital account is overdrawn by £69,863; and we have had to borrow £25,000 from our bankers for working capital.

WORK OF THE OFFICERS, STAFF, AND EMPLOYEES—THE NEW CHIEF ENGINEER OF THE SOUTH METROPOLITAN COMPANY.

Now let me conclude with a few words of appreciation of the splendid work achieved by all ranks of the Company's employees. I am convinced, after 28 years of experience of this and other concerns, that no company have, or could have, a keener, abler, or more devoted body of officers than you have. And this opinion is fully shared by others who are better qualified to judge than I am. The fly in the ointment which tempers my satisfaction is that the chiefs of other companies continually cast hungry glances at our men; and I live in fear of losing those whom I am proud to call my friends and colleagues. Sometimes an offer comes of an appointment which is so good that in all honesty we are obliged to advise that it ought to be accepted. In the half year under review, our Assistant Engineer, Mr. Geoffrey Gill (who is a son of our former Chairman, Mr. J. Blacket Gill), was offered the post of Chief Engineer of the South Metropolitan Gas Company. Such an offer, coming from so distinguished a gas engineer and administrator, and so keen a judge of men, as Mr. Charles Carpenter, could not be lightly refused; and we have lost Mr. Gill. I am assured that our loss is the gain of the South Metropolitan Company, and that Mr. Gill will render them as able and efficient service as he gave us through all the sixteen years of his work with us. He has acquired his knowledge and experience in our works; and his promotion reflects honour on this Company, and on Mr. H. E. Jones and our present Engineer, who gave him his training. We wish him every success in his new position, to which he takes the friendship and respect of all his old associates. I am happy to be able to say that we have other young men coming forward—keen, industrious, and well versed in the technicalities of their profession—who are finding now an opportunity of promotion in our service. You are already aware of the debt that we owe to Mr. Stanley Jones for his admirable administration of the Company. Much of its success is due to the keenness and energy which he inspires in his staff, and to the harmony and good feeling with which all ranks co operate with one another. This quality, which is a marked feature of our staff, is due in large measure to his example and personal influence, and reveals him as a true leader of men. Mr. Bradfield is winning a name for himself outside the Company by his useful statistics which he prepares so promptly and accurately each half year. His services to the Company are invaluable. They are your chief officers. But there are others who do splendid service, among whom I would specially single out Mr. P. E. Williams, the Manager of our Poplar works, of whose services it is impossible to speak too highly. We do not forget the gallant men who have gone from our midst to serve their country on the field of battle, six of whom have laid down their lives. Nor must we omit the brave seamen, who face the perils of winter storms, of submarines, and mines in the North Sea, to keep our works supplied with coal, and so bring to the munition and other factories of our district the heat and power without which they could not do their work. Besides these there are the managers of the different departments, the clerks, and workmen who ungrudgingly give their best service to supply the place of those who have gone to fight. A German writer, eulogizing war, has remarked that one of its advantages is that it strips men of false reputations and shows them up in their true characters. Certainly war, like every other trial, calls for all the energy, fortitude, and self-denial of which the individuals composing a nation are capable, and in this respect it reveals who is worthy, and who is not. The war has done us this service, that it has shown more clearly than ever before that the Company are served by an able, reliable, and industrious body of men who may be depended upon under all circumstances to do their utmost for its prosperity. I trust that their efforts may be crowned with success in the future, as they have been in the past.

The Deputy-Chairman (Mr. H. E. Jones), seconding the resolution, said he should not detain the proprietors, as he could not possibly add to the lucid information given by the Chairman. But he might draw two conclusions from his speech. In view of the fact that the War Department were relying upon the gas industry so much for residual products—not only for the products of tar that had been mentioned by the Chairman, but for ammonia and the acids—there was no doubt the Government would see that the main cause of anxiety to the gas industry for some years, that of getting coal, was removed, and that the requirements would be fully met. There was a security in this position that they had never had before. With regard to the needs of the Government for the products of the carbonization of coal, he had no doubt the proprietors had seen the circulars in which the Government urged people to burn gas and coke, and so save coal; for the Government had not been slow in pressing gas undertakings for a still further contribution of products which they required from them, and this, he hoped, the proprietors and the Directors would be patriotically willing to give them without any cost or profit whatever. Anything they could do for the advancement of the war they ought and should do. With regard to the position of the Company, he saw from the splendid return with which the Secretary presented them, that they had lost their place among the three premier Companies in respect of the sale of gas in London. The Brentford Gas Company had caught them up, and had passed them a little. But they all knew the development of population in the western suburbs. But, in the case of their own Company, forty years ago practically every yard of their area was built upon. In spite of this, however, their business had grown ever since. Concerning the officers, it was impossible for him to say all the Chairman had said of their Chief Engineer. If he was as good an Engineer to the Company as he had been son to him, there would be nothing of which to be afraid. As to the Secretary, he was very grateful to him, and so must be every gas politician, for the prompt manner in which he brought out every half year his statistical analysis of the London and Suburban gas accounts. The figures were a guiding line, and helped them in the administration of their various undertakings.

The motion was unanimously carried.

The Chairman moved the declaration of a dividend at the rates per annum of £4 18s. 8d. per cent. upon the 4 per cent. stock, and £4 13s. 4d. per cent. upon the 3½ per cent. stock, in both cases less income-tax.

Sir Frederick Green seconded the motion; and it was carried.

The Chairman proposed the re-election of the retiring Directors—Messrs. H. D. Ellis and H. W. Gell. He remarked that at this late period in the proceedings, he would not attempt to "gild the lily." Both gentlemen were excellent and useful Directors. Mr. Ellis had an experience of the Company extending so far back that he (the Chairman) dared not attempt to say how far back it was. Mr. Gell, like Mr. Ellis, brought to bear upon the business of the Company judgment and common sense which were invaluable.

Sir T. F. Victor Buxton, Bart., seconded the motion, which was unanimously carried.

Mr. Ellis acknowledged, on behalf of himself and Mr. Gell, the renewed mark of the proprietors' confidence.

Moved by Mr. W. G. Wilshaw, and seconded by Mr. O. C. Hills, the retiring Auditor (Mr. S. W. Savage) was re-appointed.

Mr. George Ennis remarked that the Chairman, Directors, and the whole staff had brought the Company through a most difficult period; and they deserved a very hearty vote of thanks from the proprietors in recognition of their work. He was sure the proprietors entirely approved of the expenditure of £11,000 in respect of the men who had gone to the war and the war bonus to the employees. Both the men who had gone to the war and those who could not go deserved their warmest thanks.

Mr. Wilshaw seconded the motion, which was heartily passed.

The Chairman, on behalf of his colleagues and himself, thanked the proprietors for the very kind way in which the vote of thanks had been proposed and received. It was, he said, a real source of gratification to the Directors as half year by half year the proprietors were pleased to express approval of the conduct of the Company; and the Board would very much miss it if this expression of approval were omitted.

Mr. Stanley H. Jones, on behalf of the members of the staff which he represented and the workmen, also thanked the proprietors very much for their vote, which he could assure them was greatly appreciated. What was said was read by hundreds of their workmen who received the report of the proceedings in pamphlet form, and to whom it would give great pleasure to see how they had been remembered by Mr. Bradshaw at the meeting. The references to the members of the staff would be greatly appreciated by them. They had lost Mr. Gill, their Assistant-Engineer; and the South Metropolitan Company had gained what they had lost. Mr. Gill's work was known perhaps more to him (Mr. Jones) than to any other gentleman in the room; and he could only say that Mr. Gill fully deserved his success in life. The Chairman had kindly alluded to the ship-owning question; and his father had also made reference to it. The modesty of the Chairman prevented him mentioning the part that he himself had had in the acquisition of the steamers. Their Chairman had, backed by the Deputy-Chairman, a very considerable "finger in the pie;" his (Mr. Jones's) own part having been merely to develop the idea. These steamers had spelt success for them in the past, and would do so in the future.

Mr. Bradfield, on behalf of the clerical staff, also thanked the proprietors for their continued confidence. He did not hesitate to say that they expected the vote, looked for it, and, if they did not get it, would very much miss it. It always encouraged them to further effort.

LIVERPOOL GAS COMPANY.

The Late Mr. Edward Allen.

The Annual Meeting of the Company was held in the offices, Duke Street, Liverpool, last Tuesday—Mr. H. Wade Deacon, the Chairman, presiding.

The report stated that for the year ended Dec. 31 the total revenue was £813,879, and the expenditure £673,392, leaving a surplus of £140,487. After deducting the amount taken for payment of the dividend declared last August, and the interest on the debenture stock and mortgages, and transferring £17,015 to the special purposes fund, there remained a balance of £96,357, out of which the Directors recommended a dividend for the half year ended Dec. 31 of 2½ per cent. on the ordinary stock. Owing to the additional cost of labour and materials occasioned by the war, the Directors had found it necessary to increase the price of gas to consumers 2d. per 1000 cubic feet, commencing with the current quarter. The Directors desired to place on record the great loss which the Company had sustained by the death, in July last, of Mr. Edward Allen, who had been in the service of the Company for upwards of fifty years, during the last ten of which he occupied the post of Engineer. In succession to Mr. Allen, the Directors appointed as the Company's Engineer Mr. Ralph Ernest Gibson, who has been upwards of ten years in the service of the Company as Assistant-Engineer.

The accounts accompanying the report showed that the total capital paid up and added on conversion at Dec. 31 was £2,498,905, out of £3,098,905 authorized; leaving £600,000 remaining to be issued. The amount raised on loan at the same date, including premiums, was £486,219, out of the £750,222 authorized; leaving £264,003 unissued. The capital account shows that (including the amount added on conversion) £2,985,123 has been raised, and £2,128,877 spent. In the course of the year, a sum of £19,697 was spent on new buildings, manufacturing plant, machines, storage works, &c. The reserve fund stood at £128,712, the special purposes fund account at £17,015, and the copartnership bonus and savings at £22,277 at the close of the year.

Revenue Account.—*Income.*

	£	s.	d.	£	s.	d.
Sale of gas—						
Per ordinary meters at 2s. 1d. per 1000 cubic feet	416,428	2	1			
Per automatic meters at 2s. 8d. per 1000 cubic feet	195,141	15	8			
Public lighting at 1s. 10 5d. per 1000 cubic feet	21,756	18	3			
				633,326	16	0
Rental of meters	12,513	6	3			
,, fires and cookers	13,789	19	2			
				26,303	5	5
Residual products—						
Coke (*Less* expenses)	88,394	11	9			
Tar ,, ,,	28,346	5	0			
Ammoniacal liquor ,, ,,	34,084	16	11			
Other products ,, ,,	2,844	2	7	153,669	16	[illegible]
Rents				100	0	0
Fittings				479	4	1
				813,879	1	9

REVENUE ACCOUNT.—*Expenditure.*

	£ s. d.	£ s. d.
Manufacture of gas—		
Coals, including oil, dues, carriage, unloading, and all expenses of depositing same on works	346,491 0 1	
Purifying materials, water, and sundries	9,435 15 10	
Salaries of Engineers and Superintendents and officers at works	8,988 5 7	
Wages and gratuities at works . .	55,599 5 7	
Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials and labour, *less* old materials . . .	88,748 1 0	
		509,262 8 1
Distribution of gas—		
Salaries of Surveyors, Chief Inspector, Inspectors, Assistant Inspectors, &c.	16,746 9 3	
Repair, maintenance, and renewal of mains and service pipes, including materials, laying, paving, and labour	16,591 9 3	
Repairing, renewing, & refixing meters	22,605 19 5	
" " " fires and cookers "	20,170 7 10	
		76,114 5 9
Public lamps—		
Lighting and repairing	..	1,972 0 5
Rates, taxes, and rents—		
Rents	694 15 1	
Rates and Taxes	37,979 15 1	
		38,674 10 2
Management—		
Directors' allowances	2,000 0 0	
Salaries of Secretary, Accountant, and clerks, office keepers, and messengers	10,205 8 2	
Collectors' commission and salaries .	7,691 8 1	
Printing, stationery, and advertising .	3,258 0 5	
General establishment charges and incidentals.	3,321 0 11	
Shareholders' Auditors	21 0 0	
Official Auditor	236 5 0	
		26,733 2 7
Special charges—		
Law and parliamentary charges . . .	1,964 7 3	
Contributions to officials' superannuation fund	3,109 14 0	
Moiety of superannuation to old officials	2,706 0 7	
Co-partnership bonus	8,711 3 5	
Bad debts	347 13 5	
Insurances and compensations . . .	3,796 7 4	
		20,635 6 0
		673,391 13 0
Balance carried to net revenue account		140,487 8 9
		813,879 1 9

Statement of Coal and Oil.

Description.	In Store Dec. 31, 1914.	Received.	Carbonized or Used.	In Store Dec. 31, 1915.
	Tons.	Tons.	Tons.	Tons.
Common	44,660	289,690	296,483	37,867
Cannel	716	9,842	8,945	1,613
Total . .	45,376	299,532	305,428	39,480
Gas oil—gallons . .	354,445	5,376,754	5,015,087	716,112

Statement of Residual Products.

Description.	In Store Dec. 31, 1914 (Estimated).	Made (Estimated).	Used in Manufacture (Estimated).	Sold.	In Store Dec. 31, 1915 (Estimated).
Coke—tons	11,401	199,172	37,969	171,994	610
Tar—gallons	273,768	4,354,547	17,169	4,146,028	465,118
Ammoniacal liquor—gallons	702,585	9,371,195	*Nil*	9,585,840	487,940

The CHAIRMAN, before proceeding with the ordinary business of the meeting, said: I wish to emphasize the paragraph in the Directors' report in which reference is made to the death of Mr. Edward Allen. Mr. Allen had spent the whole of his business life in the service of the Company. He entered it as a youth, and had, by dint of hard work, and by his natural ability, risen to the highest position the Company had to offer. Some of my colleagues had known him for a longer time than I had; but all who knew him at all well were impressed by the simplicity of his life and by the absolute integrity of his character. He was a very able professional gas engineer—one upon whose advice the Directors came to rely with great confidence, and in whose judgment they placed much reliance. He did his work thoroughly, and with his whole energy; and while he was a man of strong convictions, and could uphold his opinions in argument, he was a most pleasant man to work with. He was an admirable official of the Company; and he had the power of working well with all under him. By his courtesy and fair-mindedness, he had gained the respect, and I believe the esteem, of all the men in our works. His abilities were recognized by his professional brethren; and he had had the honour of filling the office of President of the Institution of Gas Engineers. At the time of his death, he was one of the members of a small committee of gas engineers appointed to secure for the Government the largest possible production of toluol by the gas undertakings of the country. If I may be allowed to strike a more personal note, I should like to say that I felt his death as the death of a friend. He was appointed Engineer at the same time that I was elected by my colleagues as Chairman; and naturally we were brought into close relationship with each other. I trusted him thoroughly; and for the ten years of our working together, I found him loyal to the core.

Proceeding to move the adoption of the report and accounts, the Chairman remarked that there were no comparative figures to which he had to draw attention, because this was the first year that they had had a full twelve months' working under the new conditions. Like every other company, they had been affected by the war. It had made difficulties for them in many ways; and he was glad to think that they had been able to do something to help the country by the extraction of toluol from the gas. At the request of the Government, they had put in the necessary plant. This had been of no advantage to the Company, from the money point of view. The difficulties were increased owing to the decreased supply of coal, and the reduced facilities of the railway companies for delivery. The question of the supply of coal had caused the Directors and officials a good deal of anxiety; but they had managed to get on so far in a satisfactory manner. At the end of the year, the Board came to the conclusion that it was necessary to increase the price of gas 2d. per 1000 cubic feet, making it 2s. 3d. He could tell the shareholders the Company were in a very good position, and the works were excellently maintained to meet every requirement. There had been a considerable increase in the sales of gas during the past year; but from various causes they might in the near future experience a reduction. With regard to capital expenditure, they applied to the Treasury for an increase of capital, and were allowed to raise £37,500. There had been about £20,000 of capital expenditure for new buildings and plant; and they had also completed the purchase of the Fazakerley undertaking from the Corporation, which was rather a unique thing for a company to do. For this transaction the amount of £15,000 appeared in the balance-sheet; and the Directors would decide how much of it would be charged to capital and how much to revenue. The cost of both labour and materials had increased, and the works had to be carried on with a depleted staff—409 of their men having joined the Colours, and more would go. Eleven men had lost their lives. The cost of war allowances and bonuses amounted almost to 1d. per 1000 cubic feet of gas. The co-partnership scheme continued to work well. In view of possible air raids, the Company had insured their property. They had also arranged with the military authorities in case of danger to reduce the pressure of the gas [*ante*, p. 379]. He thanked the officers for their loyal service. For the first time in the history of the Company they had had to employ women clerks; and he thought they were going to work very well.

Mr. J. E. TINNE seconded the resolution.

Major W. B. PEARCH asked on what authority the Board had introduced the sliding-scale into their Bill. He suggested that the shareholders make an application to the Board of Trade for an inquiry into the state of the Company and into the management.

Mr. G. H. BALL (a Director) said he had disagreed with the rest of the Board on the introduction of the sliding-scale. The effect of the sliding-scale, he contended, might be to lower the statutory dividends on the faith of the maintenance of which he and other shareholders had bought stock at a high price.

The CHAIRMAN explained that when the Bill was before Parliament it was considered advisable to concede the sliding-scale, as most other large companies had done, in face of the opposition of the Liverpool Corporation and the Labour party. The terms agreed to were not inequitable; and but for the war the price of gas would probably have fallen below 2s. 1d., and a slight increase of the statutory dividend would have been allowable. Under the same circumstances, he felt that he should act exactly in the same way again. The Directors were satisfied with the position of affairs, and as far as he knew the shareholders were. ["Hear, hear."]

Major PEARCH withdrew any further criticism, and the report was adopted; a vote of thanks being passed to the Board.

NEWCASTLE AND GATESHEAD GAS COMPANY.

Annual and Extraordinary Meetings.

At the Annual Meeting of the Company last Tuesday, the report of the Directors, which was given on p. 320 of the "JOURNAL" for the 8th inst., was adopted, and dividends were declared at the rates of 4 per cent. per annum on the preference stock and 4½ per cent. per annum on the ordinary stock.

The CHAIRMAN (Sir William H. Stephenson) said that coal had cost £210,135, an increase of £2627, and the quantity carbonized had increased by 20,527 tons. The sum of £8300 had been paid to workmen as a war bonus, to meet the additional cost of living. Gas sold to private consumers yielded £360,391—an increase of £50,666. There was a decreased consumption in respect of public lighting; but, on the other hand, the use of gas for industrial and other purposes had more than compensated for decreased sales in some directions. By arrangement with the Government, a more than ample supply of coke at less than pre-war prices had been reserved for the public during the winter. Their express motor-waggons had proved exceedingly useful. The net revenue carried forward to this year was £11,423—an increase of £5344. The Directors were advised that the profits of the Company for 1914 would not be subject to excess profits duty under the Revenue Act of 1915. The year's working had been very satisfactory indeed, especially when they took into consideration the unparalleled conditions which had prevailed during the whole of the period. Of their employees, 475 had joined the Colours. Of these, 234 were now on active naval or military service, some 190 had left the service of the Company to work in the manufacture of munitions, and 204 had attested under Lord Derby's scheme. This, out of a total of about 1593 males employed immediately preceding the war, worked out to a contribution of 54 per cent. of the Company's men. They had been materially assisted by the employment of females. He gratefully acknowledged the loyal working of the staff and employees under exceptionally difficult circumstances.

THE COMPANY'S BILL.

At the close of the general meeting, there was an extraordinary meeting, at which the consent of the proprietors was given (with three dissentients) to the Company's Bill, the principal object of which is, as already pointed out in the "JOURNAL," to remove restrictions on the Company's financial powers, and to enable the Company when necessary to raise money on the best terms obtainable.

The CHAIRMAN said the necessity for the Bill arose from the serious alteration in the value of money brought about by the war. As their Acts stood, the restrictions on the Company were such as to make it almost impossible for them to raise money on proper terms. The Company at present had power to raise new capital by (1) ordinary stock, (2) 4 per cent. preference stock, and (3) debenture stock not exceeding 4 per cent.—the latter to a total not exceeding one-third of the amount of money for the time being raised by ordinary and preference stock. What had actually been issued was 3½ per cent. debenture stock. They had power to raise £378,383 by ordinary or preference stock and £159,800 by debenture stock. With a dividend of only 4½ per cent. on the ordinary stock, however, the Company could not hope to make an issue, excepting at a large discount, while the Government were issuing Exchequer bonds running for five years bearing interest at 5 per cent. It was clear that, to raise money, stocks bearing a higher rate of dividend or interest than was within the Company's present powers must be issued. The Bill also authorized the Company to raise the maximnm dividend of any preference stock to be hereafter issued from 4 to 7 per cent., and to make the stock redeemable. While 7 per cent. was suggested as a maximum, the Direectors hoped that a less percentage might prove sufficiently attractive. Their view was that redeemable debenture stock would prove the cheapest and most attractive form of security; but much depended on the future action of the Government, as this would virtually regulate the market price of money. The Bill further proposed to substitute a calorific standard for the present candle-power standard as the test of the gas. The incandescent burner was now in use by about 99 per cent. of the Company's consumers.

Sir WALTER PLUMMER remarked that no one could see what the financial future would be; but while 7 per cent. was inserted in the Bill, it was not expected that this figure would ever be reached.

BRISTOL GAS COMPANY.

The report of the Directors which was adopted at the meeting of the Bristol Gas Company last Thursday stated that the revenue account for the year ended Dec. 31 was very satisfactory, showing a profit balance of £106,136. After paying interest on the debenture stock and a dividend on the general capital stock, there was a balance of £90,775 to be carried to the credit of the current year.

The CHAIRMAN (Mr. Fenwick Richards) said expenses all round were going up. Coal, carriage, and unloading were £20,000 more than in the previous year; and this extra sum had been incurred between August and December, 1915. During the previous seven or eight months of the year, coal was supplied at the contract prices of 1914. The prices of everything for the manufacture of gas had increased—not only coal and oil, but all the other things. In some cases people declined to supply goods on contract for twelve months, or even six months; and they had had to buy at the prices of the day. Allowances to workmen on active service appeared for the first time in the accounts, though they were mentioned at the last meeting. Of their men, 108 had gone to the front; and they were doing all they possibly could for them from a monetary point of view—making up the sum they received from Government to their full pay, so that their wives and dependants might not suffer. He regretted to say that they had heard of the deaths of six of these men. Eleven of their office staff had also joined the Colours. Among this number, there had been two losses; and two more had been invalided home. They were paying half the salaries of those from the office staff who had joined the Colours; and they hoped that those who were invalided might recover, and be able to return to their work again. They were valuable officers; and they missed them very much indeed. Turning to the credit side of the accounts, the amount received for the sale of gas was considerably more than it was a year ago; and this was chiefly owing to the increase in price from 2s. to 2s. 6d. per 1000 cubic feet. The sum was also increased to a small extent by the additional quantity of gas which had been made; and this, he thought, was very satisfactory, considering all the difficulties they had had to contend with. The additional money received from residual products had been the one relief from the anxiety and trouble they had had to contend with on the debit side. Coke figured at £20,000 more, which was very satisfactory.

Mr. J. F. EBERLE, in acknowledging his re-election as a Director, remarked upon the splendid manner in which the staff had helped to carry on the business, though they were shorthanded in many ways. This was delightful to the Board, and reflected the greatest credit on the staff.

A dividend was declared for the past half year at the rate of 5 per cent. per annum.

Smaller Street-Lamp Burners.—The Camberwell Works Committee have been in communication with the South Metropolitan Gas Company as to the fitting of smaller burners to the street-lamps, which will give an illuminating power equal to 50 candles (consuming 2 cubic feet of gas per hour), with a reduction upon the present cost. The Committee have arranged for 250 lamps to be fitted with the new burner for experimental purposes, and will report further in due course.

Ilfracombe Gas Company.—The annual meeting of the Ilfracombe Gas Company was held last Saturday week—Mr. W. C. Rafarel presiding. The Directors reported an available balance of £2504, after paying an interim dividend of 2½ per cent. on the preference and consolidated ordinary stocks. The Directors recommended a further payment of dividends at the same rate, making the full statutory dividend for the year. The Bill presented to Parliament last session received the Royal Assent on May 19; and the beneficial effects were already being experienced. In consequence of the absence of visitors and the restrictions of public lighting, there was a decrease in the sale of gas equal to 5 per cent. Notwithstanding this, however, they had not increased the price. The report was adopted.

SHEFFIELD UNITED GAS COMPANY.

Report and Accounts.

The report of the Directors, which will be submitted to the shareholders on the 13th prox., states that the gas sold during the twelve months ended Dec. 31 shows an increase of 269 488,000 cubic feet, or 5·75 per cent., over 1914, though there was a decrease in the quantity supplied for the public lamps of 106,548,000 cubic feet. The usual interim dividend of 5 per cent. was paid for the half year to June 30. The accounts now presented show that, after providing for the dividend for the remaining six months of 1915, there will be a balance of £8714 to be added to the amount previously carried forward. The cost of all materials used by the Company has risen considerably. This, coupled with the very serious increase in the price of coal, compelled the Directors to raise the charges for gas by 6d. per 1000 cubic feet from July 1 last. The average price at which gas was sold during the twelve months was 1s. 4·25d. per 1000 cubic feet.

The accounts accompanying the report show that the revenue from the sale of gas was £332,350; rental of meters and stoves, £23.331; and residual products, £214,722—miscellaneons items bringing up the total to £574,105. The following are the principal items of expenditure: Manufacture of gas, £380,945; distribution, £38,470; management, £16,423; rents, rates, and taxes, £20,595—miscellaneous items (including £2359 paid to the families of men who have joined the Army) making up a total of £463,446; leaving £110,659 to be carried to the profit and loss account.

SWANSEA GASLIGHT COMPANY.

Last Wednesday the annual general meeting of the Swansea Gas Company was held, when the Chairman (Mr. John Glasbrook) spoke of the largely increased prices the Company had to pay for practically all the commodities purchased during last year. He instanced gas oil as representing an increase of over 100 per cent.—principally due to the increase in freights from America. The receipts from the residual products, although not so good as before the war, were improving. The Company during the year fixed over 1000 gas-fires and some 1500 cookers, which was easily a record for any year. The effect of this had been to maintain the total consumption of gas as compared with the previous year, in spite of a 70 per cent. reduction in the gas used for public lighting and other reductions in consumption due to early closing and domestic economies. The Board had encouraged its employees to enlist; and about 80 per cent. of the staff of military age had either directly enlisted or attested. As to the increase in the price of gas, he stated that the principal contributory item was increased wages and generally the continual upward tendency in cost of practically all materials, which would collectively amount to an advance of not less than 40 per cent. The public were well aware of these facts, and would appreciate that a consequent increase in the price of gas was inevitable. The South Wales coals were not so suitable for gas-making purposes as those in the Midlands and the North of England, which produced about 25 per cent., or about 2500 cubic feet, more gas per ton; and this, obviously, was an important factor controlling the price of gas.

The usual resolutions were passed unanimously.

DERBY GAS COMPANY.

Annual Meeting.

In the absence of the Chairman (Colonel G. Gascoyne), Alderman J. W. Newbold presided over the meeting of the Company last Friday, and, in moving the adoption of the report [*ante*, p. 376] and statement of accounts, said that up to the present time 120 members of the staff and employees had joined the forces; and all those of military age became duly attested under Lord Derby's scheme. One member of the staff and two employees had unhappily lost their lives. The total expenditure on manufacture during the past year amounted to £122,289—an increase of no less than £26,502 on the previous year. Coals had cost £14,742 more. Repairs and renewals were £11,765 more, owing to the carrying out of certain work which the Company, on the advice of their Engineer (Mr. J. Ferguson Bell), had considered to be necessary. The principal item comprised three-fifths of the cost of the vertical retort installation at the Cavendish Street works, to replace horizontal retorts. The working results clearly indicated that there was every reason to be satisfied that the large expenditure incurred during recent years in replacement of obsolete plant had been a wise expenditure. The Board had thought it advisable to insure the three works and offices against aircraft raids. Notwithstanding the restrictions on lighting, more gas had been sold than ever before in the history of the Company. The increased revenue from the sale of gas was £10,235—due partly to the increased quantity sold, and partly to a small addition to the price, which involved a reduction of ¼ per cent. in the dividend. Residuals realized £16,659 more; and the total result was a gross profit of £33,159, as compared with £34,499 for the preceding year. These were not times for festive gatherings, so the Board decided simply to announce from the chair that at the close of the meeting the new show-rooms would be open to the public. They extended to all consumers and others a cordial invitation to visit the new premises, and inspect the latest appliances for use of gas under the best conditions, so as to obtain the highest efficiency. He thought the shareholders would agree that great credit was due to their Architect—Mr. Thorpe—and the various contractors for the skilful manner in which they had carried out what he was informed was a new departure in show-rooms. The expansion of their already large business necessitated an enlargement of the offices; and the Board decided that they would at the same time erect new show-rooms in harmony with present-day requirements. He felt quite sure the shareholders would approve the policy in having a show-room to justify its title.

The report was adopted, and the standard rate of dividend was declared on the consolidated stock at the rate of 5 per cent. per annum for the half year ended Dec. 31 last, with an additional ⅝ per cent. for the whole year, making 5⅝ per cent., less income-tax.

Replying to a vote of thanks to the staff and employees, Mr. Bell remarked that never in the history of the Company was this more deserved than now. He was glad that so many of the employees had responded to the country's call.

PLYMOUTH GAS COMPANY'S BILL.

A meeting of shareholders of the Plymouth Gas Company was held last Thursday—Sir Joseph Bellamy in the chair—when approval was given to the Bill which is being promoted this session.

At a meeting of the Plymouth Town Council yesterday week, the Gas Committee reported that a Sub-Committee had considered the provisions of the Bill, and a report by Mr. Isaac Carr (the Consulting Engineer) with regard to it; and they recommended that the proposed agreement with reference to the disposal of tar from the Devonport Gas-Works be not acquiesced in, as not being either to the financial advantage of the Corporation or to the benefit of the Ministry of Munitions. Also that the Company be informed that the Corporation would be prepared to entertain a proposal to sell tar upon a sliding-scale basis of payment. The report was adopted; and the Council confirmed a recommendation of the Gas Committee that the matter be left in the hands of the Sub-Committee, with power to act.

It is understood that the Corporation will appear as opponents of the Bill in the House of Lords, and that their opposition will be directed, among other things, to the clause relating to the adoption of a calorific standard for the gas supplied by the Company.

PIONEERS OF GAS IN PRESTON.

Some notes on Father Dunn and Mr. Isaac Wilcockson appear in the "Preston Guardian;" it being stated that they were both well known men in their day, who were much associated with the development of Preston. They were, it is said, the pioneers of gas lighting in the town, which was the first provincial one to be lighted with gas. This was just a hundred years ago. The Parish Church was the first place of worship in England lighted with gas; Horrocks, Jacson, and Co.'s was the first cotton mill to use the illuminant; and Fulwood Barracks was the first Government barracks to adopt the system. The Rev. J. Dunn, S.J., has been called the "father of the gas-works." He was instrumental in the formation of the Preston Gas Company, which was established in 1815; and he was connected with it up to the time of his death.

Portraits of both these pioneers are given; and it is remarked that that of Mr. Isaac Wilcockson is reproduced by permission of Mr. Samuel Tagg, the Manager of the Preston Gas Company, from an oil painting now hanging in the Board-room. He was associated with Father Dunn and others in the establishment of the Company—being successively Treasurer and Chairman. He filled the office of Trustee and Director for about 45 years. In 1860, the Directors, desiring to show their respect and esteem for him, had his portrait painted; and it was hung in the offices by the side of that of Father Dunn. In 1863, he resigned the chairmanship and his seat on the Board, on account of his age, and died the following year.

LIGHTING CONTRACTS AND THE WAR.

Referring in their last week's issue to the recently-tried action of "*Leiston Gas Company v. Leiston Urban District Council*" [*ante*, p. 314], our contemporary "Engineering," after recounting the main details of the case, made the following remarks.

A point deserving of special notice, upon which the learned Judge laid due stress, is this: That the contract in so far as the Gas Company were concerned was partly executed; they had provided the plant and supplied the lamps. Those who desire to cite this case as an authority for the proposition that in all cases where the lighting of lamps is prohibited the bill of a gas or electric lighting company must be paid, should specially note this point. There are probably many cases where lighting companies are bound to provide light *simpliciter* (whether as electric energy or coal gas), without providing anything in the nature of plant. Can it be said, in such a case, that the local authority must pay for light which, owing to the making of a restriction order, it has never used?

Much depends upon the terms of the contract. Suppose it was to supply "such quantity of gas [or electricity] as may be necessary to light the streets of Slocum-on-the-Mud at 2s. per 1000 cubic feet [or 1½d. per unit] for the space of five years," can it be said that the intervention of a lighting order, preventing the lamps being lit, would enable the gas company to sue for anything? It is submitted that it could not, although it is quite possible that the "town lighting" may have made it necessary to instal or retain certain expensive machinery.

Now let us introduce another term. Suppose the contract is as above, but subject to a minimum "rent" of so much per burner or lamp per annum. In that case, if lighting were stopped by a military order, the local authority might say that the contract was entered into on the footing that the streets were to be lit as in normal times, and refuse to pay even the minimum.

That they might so refuse seems to follow as a logical deduction from the well-known case of "*Krell v. Henry*" (1903), 19 T.L.R., 711, which arose in consequence of the postponement of the coronation. A man had agreed to let his flat for £75 in Pall Mall on two days, to "view the coronation." The function having been postponed, the "tenant" refused to pay anything. The Court of Appeal held that he was not liable, on the ground that when the contract was made it was not within the contemplation of the parties that the procession would not take place. They held, in effect, that it was an implied condition that the procession would take place. By a parity of reasoning, in the supposititious case above mentioned, it is an implied condition that the street lighting shall be normal during the currency of the agreement. If war supervenes and makes performance impossible, it is submitted that the gas company could claim nothing.

Had it not been that in the case before Mr. Justice Low the contract was partly executed, there must have been judgment for the defendants; and one may be permitted to doubt whether the proper course would not have been to direct an inquiry as to how much of the sum claimed was due "on capital account" and how much for the supply of gas.

The subject is a difficult one; and there are hardly any authorities bearing upon it. There is one case (not cited to Mr. Justice Low) which may usefully be referred to. There an attempt was made (in 1893) to avoid payment for gas to be supplied at so much per lamp on the ground that certain lamps were not lit. By a local Act, the charge for supplying gas to the public lamps at Richmond, including the providing and use of such lamps, "shall be £4 5s. per lamp per annum, subject to an increase or reduction of 5s. per lamp per annum for every increase or reduction of 3d. per 1000 cubic feet to the ordinary consumer within the said parish; the said lamps to be lighted from sunset to sunrise, and the burners used therein to consume not less than 5 cubic feet of gas per hour." During certain months it frequently happened that many of the public lamps in Richmond were not kept alight during the prescribed period—the admitted cause being severe frost. The Gas Company made special efforts to overcome the difficulty. The Richmond Corporation contended that the Company were not entitled to recover the full statutory charge, but only such sum as might be reasonable, having regard to the gas actually provided. It was held that full effect could only be given to the Statute by treating the £4 5s. per lamp per annum as a lump sum to be paid by the Corporation, which could not be apportioned or divided, and that it was no answer to say that the lamps were not alight during the whole of the prescribed period by reason of a cause admittedly inevitable [*re* "*Richmond Gas Company v. Mayor of Richmond*" (1893) 1 Q.B. 56].

In that case it will be noticed that the Gas Company were to provide the lamps as well as supply them with gas; so it is on all-fours with Mr. Justice Low's decision. Enough has, however, been said to show that the case of Leiston must not be relied on to establish a proposition which is too broad.

Toluol Extraction at Wombwell.

On the submission of the minutes of the Gas and Water Committee at a recent meeting of the Wombwell Urban District Council, the Chairman (Mr. J. E. Mitchell) stated that the toluol extraction plant lately installed by the Council at the gas-works, for the purpose of taking from the gas materials for the manufacture of high explosives, was now at work; and Wombwell had the distinction of being the first authority in England to engage upon such operations by this particular process. The Chairman of the Council (Mr. A. E. Allott, J.P.) remarked that great credit was due to Mr. Mitchell and to Mr. P. D. Walmsley, B.Sc. (the Gas Engineer and Manager), for their initiative in the matter. The plant was capable of dealing with more than their own requirements, so that they might hope to become a central receiving depôt, dealing with material sent to them by neighbouring undertakings. The plant here referred to has, we understand, been designed by Mr. Mitchell and Mr. Walmsley for washing out of the gas the whole of the benzol and toluol, and its subsequent removal from the washing medium in the form of crude benzol. This crude benzol is at present being sent away to a neighbouring plant for rectification; but it is the intention of the Council eventually to instal a rectification plant of their own, so as to supply pure toluol and pure benzol. By the process now adopted at Wombwell, it is hoped to recover quite easily four times as much benzol and toluol as was recovered previously.

Farmers and Sulphate of Ammonia.

In the course of a practical demonstration on the manufacture of sulphate of ammonia at the New Brancepeth Colliery, following on a course of lectures, Mr. F. P. Walker, the Adviser in Agriculture to the Armstrong College, said that fortunately sulphate of ammonia was a home product, and there was a very full supply of this most valuable source of nitrogen. Usually it was exported in enormous quantities to countries which fully recognized its great value as a fertilizer. For the present, its exportation had been stopped, and the price for February at the works fixed at £16 10s. a ton. If, however, prevention of exportation was to be continued, it was only reasonable that manufacturers should receive from the farmers as early intimation as possible of what quantities they would require. The earlier the delivery could be effected, the better; for in March, April, and May, when it would be urgently wanted, railway facilities were likely to be further straitened through the demands of the war. As there was plenty of room for the greatly increased use of quick-acting nitrogenous manures on innumerable farms, he strongly urged farmers to give the matter their most serious attention. Sulphate of ammonia was at the present time one of the cheapest sources of nitrogen, and, weight for weight of nitrogen in the other forms of artificials, would give equally good results, and in some cases better. One of the secrets of the successful use of sulphate of ammonia was its early application; and its great advantage was that it could be used either when sowing the seed or as a top-dressing. Another point he would strongly emphasize was that in the use of quick-acting nitrogenous manures generally it was most essential to keep crops growing by their use, as distinct from waiting for the crop to show serious signs of failing before applying them.

A fire at the house of the Duchess of Bedford in Berkeley Square (by which it appears that her bedroom was practically burnt out) is said to have been caused by the fusing of an electric wire.

NOTES FROM SCOTLAND.

Edinburgh Corporation and Automatic Gas Lighting.—As stated last week [*ante*, p. 379], a Sub-Committee of the Cleaning and Lighting Committee of the Edinburgh Town Council paid a visit to Messrs. Alder and Mackay's works, where a demonstration was given of the firm's automatic system of lighting and extinguishing street-lamps. A meeting of the Committee was held on the 14th inst., at which the Sub-Committee recommended that the experiment be made in two districts, one to be selected by the Corporation and the other by the Gas Commissioners. The recommendation was approved, and was remitted to the Sub-Committee to carry out. It was stated that the Gas Engineer (Mr. Alexander Masterton) is engaged in testing the various district governors. The Convener of the Committee (Judge Stark), who is also a Gas Commissioner, is confident that the experiment will be successful, and that the system will ultimately be applied to the 10,000 gas-lamps in the city, and so effect a saving of from £2000 to £2500 per annum. The lamplighters, afraid that their occupation is seriously threatened, held a private meeting recently, with what result is not known.

Alloa Vertical Retorts.—The Alloa Corporation Gas-Works have benefited considerably by the placing in position of the new vertical retorts. The saving in coal and the additional revenue from the residuals have enabled the Town Council to lower the charge for gas to all classes of consumers by 2d. per 1000 cubic feet. To domestic consumers the rate per 1000 cubic feet is 2s. 5d. The Engineer and Manager of the works (Mr. J. W. Napier) gave some very interesting particulars of the installation in a paper he read in Edinburgh last Wednesday—see *ante*, p. 407.

A New Lighting Order for Glasgow.—A new lighting order to come into force next Friday will reduce the output of gas in Glasgow. Streets, factories, workshops, and dwelling houses are all affected, and less light will be seen anywhere, as the order is a severe one.

A New Company at Stranraer.—A Company just formed is that of the Stranraer Gas Company, Limited. The capital is £13,000, in £1 shares; and the new concern takes over the works and assets of the Sanquhar Gas Company.

Gas-Works Troubles at Perth.—The report of Mr. John Lambert, the Burgh Electrical Engineer, in connection with the breakdown of the machinery at the gas-works, has been again referred to in the Perth Town Council. The trend of Mr. Lambert's observations was indicated in the "JOURNAL" for the 8th inst. [p. 324]. At the close of his report, he said: "Owing to the large amount of plant at the gas-works, and the somewhat trying conditions under which it is running, it will be necessary to bestow upon it much more attention in the future, if good results are to be obtained and breakdowns minimized. I have no hesitation in saying that many of the electrical troubles have been caused to a great extent by want of thorough examination; and this can be attributed to the difficulty (in some cases almost impossibility) of getting at the motors and other apparatus." The Emergency Sub-Committee (at whose request the report was made) recommended, and the principal Committee and Town Council adopted the report, and remitted it back to the Sub-Committee with powers to arrange, along with the Gas Manager (Mr. David Vass) and the Electrical Engineer, to carry out the detail of the work and additions to the plant referred to in the report, in such manner as to cause as little interference as possible with the gas supply.

A Discussion in the Council.—Lord Provost Scott presided at the monthly meeting of the Perth Town Council, which took place on Monday evening of last week; and during the proceedings some strong criticism was made upon the management at the gas-works, following upon the report prepared by the Electrical Engineer, which has just been referred to. Ex-Treasurer Rollo said he did not think the matter could be passed over without something being said on the subject, because it was a very strong report. It seemed that there was no one looking after the electric stoking plant at the gas-works. Was the Gas Manager to be allowed to go without a reprimand from the Council in face of a report like this? It was a disgraceful state of affairs; and the report clearly showed there was something radically wrong. Approval of the minute embodying the report having been moved, ex-Treasurer Rollo moved disapproval of it, saying he was prepared to go a little farther. After reading the report over, he felt there had been a good deal of carelessness on the part of the Manager in not looking after the electric plant. Everything appeared to want renewal, and it seemed that Mr. Vass had not been attending to the electric plant, while they had nothing to prove that he had been looking after the other parts of the machinery. There was not the slightest doubt that matters were in a disgraceful state; and now was the time to call the Manager to book. He was going to move, whether he got a seconder or not, that they ask Mr. Vass to send in his resignation, or that they give him three months' notice. Ex-Bailie Macpherson asked if Mr. Rollo's motion was a competent amendment to departmental work which had been undertaken by the Emergency Committee, who were appointed by the Town Council to do this kind of work. The standing orders having been referred to, the Lord Provost said it was clear that the character of their officials had to be safeguarded to a certain extent; and while he did not deny Mr. Rollo's right to raise the question of the dismissal of Mr. Vass, he thought that he should give notice of motion. It would be more satisfactory. At the close of the meeting, Mr. Rollo gave notice of motion—"That the Gas Manager be asked to send in his resignation."

* * *

The Richmond Gas Stove and Meter Company, Limited, have designed a folder advertising the "R. H. D." semi-circular fronted gas-fire, which they claim to be "the first and only gas-fire on the market distributing heat to all parts of the room." There are illustrations of the main lines of radiation emitted.

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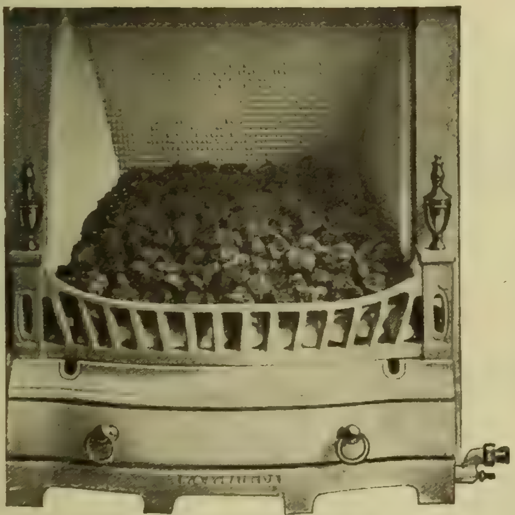

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Feb.* 21.

In tar products the position generally presents no new feature. It is stated that the possibility of utilizing pitch for gas making is being examined in various parts of the country, and the prevalent view is that for such purpose pitch is worth coal price. For export, makers still quote pitch at 19s. to 19s. 6d. per ton net in bulk at works. Creosote remains steady at 4½d. net in bulk; while solvent naphtha and various forms of naphthalene are in strong demand.

With regard to sulphate of ammonia, notwithstanding the serious inconvenience caused by the temporary stoppage of export licences, the market export value is unchanged at £17 5s. net per ton, filled into buyers' bags at sellers' works for 25 per cent. quality. After supplying the home demand, there is no doubt that stocks are accumulating at makers' works, which is damaging to the sulphate industry both at home and abroad, where our Allies need the material for agricultural purposes.

Tar Products in the Provinces.

Feb. 21.

The markets for tar products remain about the same. Pitch is still very quiet, and transactions are few and far between. Creosote is weaker, and sales are reported at lower prices. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 16s. 9d. to 20s. 9d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. 1d. to 2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2½d. to 2⅝d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Feb.* 19.

The market has remained without alteration throughout the week, and at the close the quotations are £16 17s. 6d. per ton f.o.b. Hull, £17 per ton f.o.b. Liverpool, and £17 5s. per ton f.o.b. Leith. The export area is limited by the action of the Government, and supplies have been ample to cover all actual requirements. Nothing of importance has transpired in the forward position; producers being inclined to wait the effect of the restrictions of exports, and exporters being unwilling to pay any substantial premium on prompt prices.

Nitrate of Soda.

The market remains firm at 16s. 9d. per cwt. for ordinary quality, and at 17s. 9d. for refined.

Sulphate of Ammonia.

From another source, it is stated that the prices are as last week. Outside London makes, £16 12s. 6d.; Hull, £17 5s.; Liverpool, £17 7s. 6d.; Leith, £17 7s. 6d. to £17 10s.; Middlesbrough £17 7s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is active, but delay of steamers is impeding trade, though shipments continue fairly good in the circumstances. In the steam coal trade, the prices are generally firm, and more especially so for early delivery. Best Northumbrian steam coals are strong generally; but the quotation is now from 30s. to 32s. 6d., according to the time of delivery. Second class steams are 25s. to 30s. per ton; and steam smalls are quiet at 13s. to 17s. per ton. The output is fairly maintained; but new regulations as to foreign-trading vessels, and as to the export of unscreened coals to neutral countries, make forward trading difficult, so that there is not the contracting ahead that is usual at this season. It will be seen, however, that prices remain at the recent advance. In the gas coal trade, best Durhams are from 25s. per ton f.o.b.: second-class gas coals are about 24s. per ton; and "Wear Specials" are from 25s. to 26s. per ton f.o.b. The freight market is quiet, with fewer transactions; but the Tyne to London rate is near 14s. 6d. Gas coal to Havre is still quoted at 30s. for freight from our local ports. Some of the large producers of gas coal in Durham complain of the very limited output after the Government's requirements are met, so that there is little free for sale, and thus the high prices named only apply to small quantities sold. The deliveries under contract will, however, be reduced in some cases after the end of this month. Possibly this is one of the reasons why some sellers ask higher figures than those quoted for gas coals, and thus the values are a little irregular, both for best gas coal and for some other Durham kinds. In coke, values are well maintained. There are tolerably full exports of gas coke, the quotation for good makes of which is from 27s. 6d. to 29s. per ton f.o.b. in the Tyne.

Water-Works Insured against Air-Raids.—The Liverpool Water Committee have decided to insure against air-raids the whole of the works, both in Liverpool and at the various watersheds, for the sum of £3,500,000.

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Old Broad St., E.C.

Improved Working at Uxbridge.

Attention was called by a shareholder, at the annual meeting of the Uxbridge Gas Company, to the fact that, though there was less coal used last year, a larger quantity of gas was made than in the preceding twelve months. The Chairman (Mr. H. E. Jones) remarked that this was due to the new retort-house being brought into use; and it proved what good work their Manager (Mr. Charles Hulme) and his staff had done for them. The report adopted stated that there was a sum of £9242 available for division; and the Directors therefore recommended the payment of a dividend at the full statutory rate of 5⅞ per cent., less income-tax, for the year on the consolidated stock. This leaves a balance of £552 to be carried forward. At a subsequent special meeting, a resolution was unanimously passed approving of the Bill being promoted by the Company to bring about the acquisition of the Eton Gas Company.

Unusual Experience for Merthyr.—For the first time for many years, a reduction is shown in the consumption of gas at Merthyr Tydfil. At the annual meeting of the Company, the Chairman (Mr. Henry F. W. Harries) said this was due to early closing and the mild weather; and a further decrease might be expected during the current year, owing to the reduced public lighting. Dividends were declared at the rate of 5 per cent. per annum on the preference and ordinary stocks of the Company, both less income-tax.

Confidence at Wellington (Salop).—Though the sale of gas over the past year showed a decrease of 3 per cent., as compared with the preceding twelve months, the Directors of the Wellington (Salop) Gas Company share the confidence of the gas industry generally that a return to normal circumstances will bring about again the steady progress to which they have become accustomed. Nearly one-half the falling-off was accounted for by the reduction in the quantity used by the Council for water pumping. A dividend, making a payment for the year of 5⅝ per cent., less income-tax, was declared at the annual meeting. The quantity of gas actually sold per ton of coal carbonized last year was 11,943 cubic feet.

Coke-Fired Lorries.—Referring to the growing popularity of the coke-fired steam motor-lorry, the "Municipal Journal" remarks that in the provinces the Manchester Corporation are the pioneer municipal authority in regard to the use of this type of vehicle. Some time since the Gas Committee purchased one; and the acquisition of another 3-ton coke-fired steam-lorry chassis from the National Steam Car Company, Limited, has now been decided upon. As to London, it is pointed out that vehicles of this type have been purchased by the South Metropolitan, Wandsworth, Tottenham, South Suburban, and Croydon Gas Companies. Ordinary gas coke is used, graded to pass a 2-inch mesh and not to pass a ¼-inch mesh; and, power for power, coke fuel is claimed to be only about one-sixth of the cost of petrol at the present time.

Colne Valley Water Company.

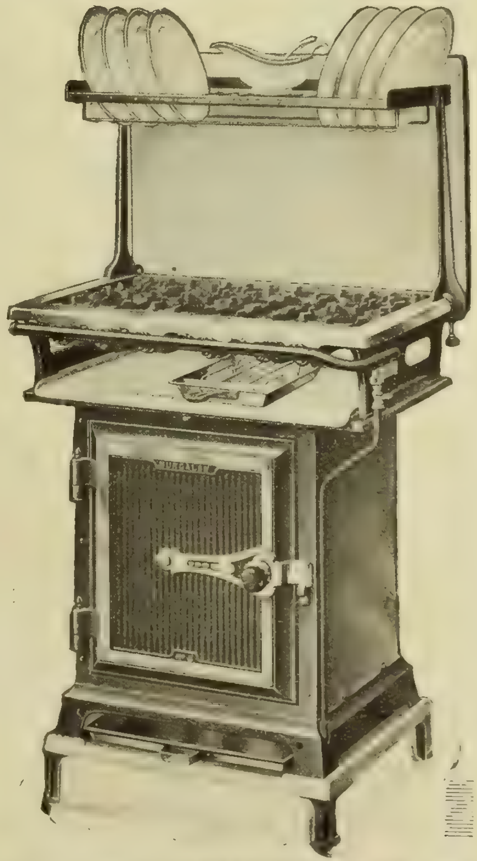
The half-yearly meeting of the Company was held last Tuesday, when the Directors reported that the capital expenditure during the half year ended Dec. 31 was £6326, which included the final payments to contractors for the new beam-engine and buildings at Eastbury pumping-station, the laying of the new 8-inch main to Boreham Wood and Shenley, and several extensions of mains for affording new supplies to consumers. Supplies have been provided for the erection of 115 buildings; while 271 new supplies have been added to the Company's books. Owing to the war, the contract for the second beam-engine at Eastbury has been unavoidably delayed; and it is unlikely that the engine will be available during the present year. The Directors regret to announce that, owing to failing health and advanced years, it has been found necessary to relieve from active service Mr. John Blackburn, who has been the Company's Resident Engineer for forty years. A pension has been granted him in consideration of the valuable services he has, throughout his career, rendered to the Company. The profit in respect of the revenue account amounted to £18,491. The balance of the dividend and interest account, after paying the interest on debenture and preference stocks, and transferring £2000 to the contingency fund, was £27,835. Out of this, the Directors recommend the payment of the full statutory dividends at the rate of 10 and 7 per cent. per annum on the several classes of ordinary stock, and in addition a payment of 1 per cent. (actual) on account of back-dividends on the "A," "B," and "C" stocks—leaving £14,906 to be carried forward.

Folkestone Gas Bill.—At a special meeting, the Sandgate Urban District Council have unanimously passed a resolution approving of opposition to the Folkestone Gas Bill. Remarks made, however, appear to justify the hope that an agreement with the Company may be come to on outstanding points before the Committee stage of the Bill is reached.

Wandsworth, Wimbledon, and Epsom District Gas Company.—The half-yearly meeting will take place next Tuesday, at the Westminster Palace Hotel, when the Directors will submit a report stating that the revenue account for the six months ended Dec. 31 shows a profit of £38,865. After providing for the interest on debenture bonds and stock, and on deposits and loans, there remains to the credit of the profit and loss (net revenue) account an amount of £32,097 available for payment of dividends. The Directors, therefore, recommend that dividends be declared at statutory rates as follows: On the Wandsworth "A" stock, £7 17s. 6d.; on the Wandsworth "B" stock, £6 7s. 6d.; on the Wandsworth "C" stock, £5 10s. 3d.; on the Wimbledon stock, £5 15s.; on the Epsom stock, £6 7s. 6d.; and on the new ordinary stock, £5 10s. 3d. per cent. per annum. The sale of gas in the half year showed a small increase of 0·5 per cent. over the corresponding period of 1914. The increase in the number of consumers was 738, and in stoves at rental 2514.

Richmond's Bungalow Cookers

SUPPLIED in four sizes, Richmond's "Bungalow" Cookers contain many special features of great practical utility. The Oven raised to prevent stooping; the hygienic advantage of the raised stand avoiding collection of dirt beneath cooker; the convenient hotplate with patent griller of increased efficiency, and the rack (Patent No. 4975/1914) holding plates in vertical position, are all features which strongly appeal. Right hand illustration shows the new size 'Bungalow' No. 3.



The RICHMOND
Gas Stove & Meter Co., Ld.
London & Warrington.

Hebden Bridge Board and Insurance.—At the monthly meeting last Thursday of the Hebden Bridge and Mytholmroyd Gas Board, the question of insuring the Board's property against damage by enemy air-craft was introduced. After discussion, the Clerk was empowered to get quotations with the object of insuring the property.

Lostwithiel Gas Company.—Mr. J. H. Jeffery (the Chairman) presided at the annual meeting of the Company last Wednesday. The Directors reported that during the first half of the year, when troops were billeted in the town, the consumption of gas was a record in the history of the undertaking; but since May less gas had been used than in former years. The price was advanced in June. The supply of coal and materials for the ensuing year was causing much anxiety. Dividends of 6s. 3d. on the "A" shares and 1s. 3d. on the "B" shares were declared.

Extension of Devonport Gas Plant.—The Plymouth Town Council yesterday week adopted a report of the Gas Committee recommending that the Consulting Engineer of the Devonport Gas-Works (Mr. Isaac Carr) be instructed to invite tenders for an extension of the water-gas plant, and also for new saturators for the sulphate plant. The erection of new oil-tanks at the works has been commenced. The report of the Gas Engineer (Mr. W. P. Tervet) showed that the output of gas during December last was 8·08 per cent. in excess of the corresponding month of 1914.

Croydon Gas Company.—The report to be submitted at the half-yearly meeting next Friday states that the sales of gas for the six months ended Dec. 31 exceeded those of the corresponding period of 1914 by 2·19 per cent. The number of consumers increased in the half year by 613; that of stoves on hire is greater by 663 cookers and 2535 fires, while 84 and 349 respectively have been sold to consumers, representing a total increase in gas-stoves of 3631. After providing for all fixed charges, there remains available for division a balance of £34,773; and the Directors recommend that dividends be declared for the half year at the rates per annum (less income-tax) of 14½ per cent. on the "A" stock, 11½ per cent. on the "B" and "C" stocks, 5 per cent. on the "D" stock, and 10 per cent. on the "E" stock. The dividends will absorb £24,103, leaving £10,670 to be carried to next account.

Bangor (co. Down) Gas Supply.—Mr. P. C. Cowan, the Chief Engineering Inspector of the Irish Local Government Board, has held an inquiry into the Bangor Urban Council's application for a Provisional Order for the taking over of land and property to enable an extension of the gas-works premises to be made. Mr. Barker Mitchell, the Gas Manager, said there was a great necessity for more storage if an uninterrupted supply of gas was to be maintained. Mr. Cowan favoured friendly negotiation between the parties concerned, so as to obviate the issuing of an official order. The Urban Council agreed to an increase in the salary of Mr. W. Scotland, the Assistant Gas Manager from £84 to £104 per annum; granted a bonus of £50 to Mr. H. C. Bell, the Town Surveyor, for the preparation of plans in connection with the proposed Provisional Order; and agreed to a bonus of £50 to the Gas Manager.

West Cheshire Water Company.—The Directors' report for the year ended Dec. 31 stated that the balance at credit of profit and loss account amounted to £7490, which, with £14,750 brought forward from the previous year, made a total of £22,240. Of this, interim dividends at the rate of 5 per cent. per annum, paid in August, absorbed £3000, leaving a balance of £19,240 available. The Directors recommended the payment of another dividend at the rate of 5 per cent. per annum on all classes of shares, absorbing £3000, and leaving a balance of £16,240 to be carried forward to the next account.

West Surrey Water Company.—At the half-yearly meeting of the Company last Tuesday—Mr. A. Telford Simpson presiding—a maximum dividend at the rate of 7 per cent. per annum was declared upon the ordinary £10 shares issued under the Acts of 1877, 1888, and 1901, and a maximum dividend at the rate of 10 per cent. per annum upon the ordinary £10 shares issued under the Act of 1869. The report showed that the income for the six months ended Dec. 31, after making provision for empty houses, irrecoverable rates, &c., amounted to £9546, and the expenditure to £4445. The additional supplies connected during the half year represent an increased future rental of £241 per annum.

Yeadon Water Bill.—The Yeadon Water Company's gathering grounds at Hawksworth are near to those of the Baildon Council; and, as it was considered that certain provisions of the Company's Bill affected the interests of the Council, a special meeting was recently held, and it was decided by 7 votes to 3 to oppose the Bill. According to a memorandum to the minutes submitted to the Council last Tuesday, it appears that, on the day following the special meeting, the Chairman delivered to the Clerk a notice in writing withdrawing the vote given by him in favour of taking action, thus reducing the number of votes to 6 against 3, which is not a sufficient majority to make such a resolution operative. The minutes were passed; it being understood that the action of the Chairman had prevented the intended opposition to the Bill.

Birmingham Air-Raid Precautions.—In the course of a statement furnished to the Press by the Lord Mayor of Birmingham (Alderman Neville Chamberlain), on the subject of precautions against air-raids, the public are informed that the extent and degree of public lighting in the city is at the discretion of the Chief Constable; and the Watch Committee have indicated to him that in their opinion one light at each street corner or dangerous spot is sufficient, and that all other public lights should be discontinued until further notice. They have further indicated to the Chief Constable that they think there should be more uniformity in the lighting of shops, and that observance of the Home Secretary's order should be strictly enforced. When public warning is given of an anticipated air-raid, all street-lamps will be extinguished; and the lights in any shops or houses should be at once put out. Lamps on trams and omnibuses and all public and private conveyances must also be extinguished. Factories, too, should at once stop work, and extinguish all lights.

Economy

The necessity that is upon all of us to practise rigid economy furnishes a potent argument for the adoption of DAVIS Cookers for the coming season's trade.

Davis Cookers stand for—

1.—Economy in maintenance work and charges—a matter of great and growing importance to every Gas Undertaking.
2.—Economy in gas consumption—a no less vital consideration to gas-cooking consumers.

Orders from stock executed in due rotation.

THE DAVIS GAS STOVE CO., LTD.,
The Gas Exhibition Salons,
60, OXFORD STREET, LONDON, W.

No Advances in Salaries at Darlington.—The Darlington Gas Committee last Friday rejected applications from the Assistant Engineer for an advance of salary, and for the fixing of a maximum salary to be reached by annual increments; and from the Works Chemist, for an advance. The Committee announced that they would not consider questions of increases during the continuance of the war.

Hull Water Supply.—The Hull Corporation Water and Gas Committee have declined to sanction a recommendation made by the Water Engineer (Mr. C. B. Newton) to abolish outside all water-taps [see *ante*, p. 274]. The Engineer was of the opinion that, in order to conserve the water supply and reduce waste, no further increase in the number of outside taps should be allowed, and that, as existing taps of this character became worn out, they should not be renewed except in the cases where they formed the sole supply to houses. Alderman T. S. Hill observed that the Engineer had made the initial mistake of attempting to put this policy into operation without consulting the Committee, which had created a great amount of feeling. The Chairman (Mr. P. Gaskell) said that there were far-reaching matters which would develop out of the Engineer's report. Mr. T. B. Atkinson remarked there were hundreds of houses in Hull where it was of the greatest importance that the outside gullies should be flushed. The Committee have resolved to make a grant of £15,000 out of profits to the relief of the rates. According to a statement prepared by the City Accountant, the net surplus for the past year was £14,550; but there was an estimated saving of £2000 on renewals and additions.

Salisbury Gas Company.—At the half-yearly meeting of the Company, the Chairman (Mr. George Fullford), moving the adoption of the accounts and the payment of the full dividends, said he was the more pleased to do so because the abnormal situation caused by the war had resulted in the cost of coal, labour, and all other materials used in the manufacture and supply of gas being largely increased, and there appeared to be no immediate prospect of any relief, and in other ways many difficult questions had arisen that called for their serious consideration. The supply of coals had improved; but materials, from a variety of causes, were often delayed. Consequently much larger stocks than usual had to be kept as a measure of precaution. Against all this they only had 3d. more per 1000 cubic feet of gas from private consumers, and no increase from public lighting. Owing to the Lighting Order, the revenue from the latter had fallen off by some £400. There had been a very good increase in the consumption of gas for private lighting, heating, and cooking. Tar prices were low at present. Their tar went to the distilleries for the extraction of the light oils for the manufacture of high explosives. Sulphate of ammonia sold better, and, with the scarcity of animal manure, if gardeners knew the value of this artificial manure, all their output ought to be used in the immediate district. They had now had their new Engineer and Manager (Mr. W. Fielden) with them for four months; and they were very well satisfied. He had good technical and practical knowledge, gained in large, well-ordered works; and the commercial side of his character would specially commend him to the consumers.

Spenborough Water Charges.—The price to be paid by the Spenborough Urban District Council for water supplied in bulk by the Bradford Corporation is the subject of arbitration proceedings taking place in London this week. The district has for some years obtained its water supply from Bradford; the price at present paid being 9d. per 1000 gallons.

Herne Bay Water Company.—A dividend at the rate of 5 per cent. per annum for the half year ended Dec. 31 upon the ordinary stock of the Company was declared at the meeting last Tuesday. In the report, it was remarked that, "having regard to the reduction of receipts for the past year, which is entirely due to the war, and the improbability of there being any substantial improvement in the current year, the Directors are of opinion that it would be prudent to reduce the dividend on the ordinary stock to 5 per cent. per annum. But they have no reason to doubt that on the return to normal conditions the net revenue will be sufficient for payment of dividends as before." The income for the past six months, after making provision for empty houses, irrecoverable rates, &c., amounted to £2850, and the expenditure to £1480.

A proposal by the Water Committee of the Plymouth Corporation to purchase the watershed and certain lands below the Burrator reservoir was approved by the Town Council yesterday week. The total area to be acquired is 4891 acres; and the Corporation are to pay a perpetual chief rent of £825 per annum, and to have the right of redeeming this at any time for £22,000. A sum of £125 per annum for seven years is to be allowed by Sir Henry Lopes, the seller of the land, in respect of certain apportioned rents. Alderman R. W. Winnicott (the Chairman of the Water Company) said the purchase of the land would enable the Corporation to guard against the possibility of contamination of the water. The scheme would be practically self-supporting.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

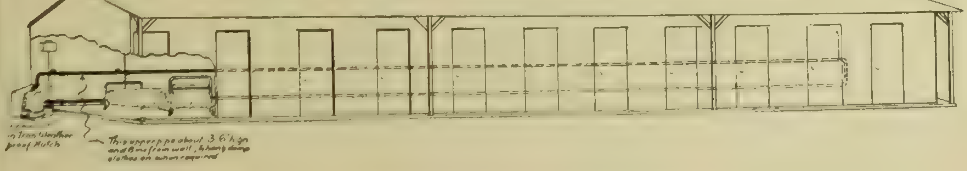
The "Acmefont" Gas-Heated Boiler.

The "Acmefont" is specially suitable for warming Cubicle Buildings used for Sleeping Accommodation, Sick Bays, Changing Clothes, &c. The heating of each hut is under separate control, and this system of heating possesses advantages in

WORKING,
FIRST COST, and
MAINTENANCE

which a centrally-fired system cannot offer.

EXPERT OPINION FREELY GIVEN BY WELL-KNOWN HEATING SPECIALISTS.


in Iron Weather proof Hutch
This upper pipe about 3 6" high and 8 ins from wall, to hang damp clothes on when required

ARDEN HILL & CO.,
Acme Works,
BIRMINGHAM.

STOCK MARKET REPORT.

The week just completed on the Stock Exchange was not quite up to the level of its predecessor in the point of quality. Not that there was much to complain of in regard to the number of recorded transactions, but they were largely in lines of inferior importance. The more dominant and influential markets were rather languid and devoid of interest, while at the same time exempt from any pronounced weakness. Among the gilt-edged division, War Loan was firm and Consols moderately so, and the demand for Colonial issues was maintained. Home Rails were no better than dull, though the annual reports were as good as was expected as a general rule. Americans were weak, for reasons international and domestic which are much in the public view. Canadian Pacific was momentarily depressed at the prospect of the new Excess Profits Duty, but upon reflection made a prompt recovery. Meanwhile, the increase in its profits is going on gaily. The Foreign Market was not strong, and the French loan eased perceptibly. Argentines were inclined to droop, owing to harvest prospects being less clear; and South Africans were quiet and dull. For buoyancy and animation one must again turn to the Miscellaneous group, where rubber, oil, and copper were in full swing. Among the interesting topics of the week, of chief importance was the question how best shall the sinews of war be raised. The Government attach much importance to the development and extension of the Dollar Mobilization Scheme. The response of the public, as sellers, has been satisfactory, it is believed, and the Government now are understood to be about to start the borrowing part of the scheme. The terms of agreement will require careful consideration, for the depositors could scarcely be asked to concede a free hand to the bailees to purchase loaned securities at some future date at prices now unknown. Upon the question of issuing Bonus Bonds, the Montagu Committee have not arrived at a recommendation. The French scheme for negotiating French-owned stocks here has not further materialized. Business in the Gas Market was, if possible, even quieter than ever. Excluding the premier Company, not a score of bargains could be compiled out of the whole list of quotations. But so far as there was material whereby to gauge the tendency, it was quite satisfactory. The Money Market was unchanged.

Bargains done for cash during the week were as follows: On Monday, Commercial 4 per cent. 75, Gas Light ordinary, 75, 76. On Tuesday, Bournemouth "B" 12, Buenos Ayres debenture 71, Gas Light ordinary 75, 75⅛, 75¾, Imperial Continental 65. On Wednesday, Gas Light ordinary 75¾, Primitiva preference 3¾. On Thursday, Cape Town preference 4¾, 4⅞, Gas Light ordinary 75, 75⅛, 75¼, 75½, 75¾, Primitiva 2, 2$\frac{1}{32}$, South Metropolitan 75⅞, 76. On Friday, European 12½, Gas Light ordinary 75½, 75¾, ditto maximum 60¾, ditto debenture 61, 61¼. Imperial Continental 64½, 65, Primitiva 2$\frac{1}{16}$, 2⅛, ditto preference 3$\frac{9}{16}$, 3⅝, South Metropolitan 75½, 76. Among unquoted undertakings, bargains were done in Sunderland at 193, and Swansea at 92½, 93.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div. or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5¼	Alliance & Dublin Ord.	59—64	8 18 2	..
874,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd. . . .	5⅞—6⅜	5 17 3	..
60,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c. . .	29—30	5 6 8	..
333,110	10	"	7	7/-	B 7 p.c. .	15—15½	4 10 4	12
115,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	†6/-	Brentford Consolidated	261—266	5 5 8	..
734,9.0	"	"	†11	55/-	Do. New . . .	204—209	5 5 8	..
55,000	"	"	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
221,400	"	June 11	4	4	Do. 4 p.c. Deb. .	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¼	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¼	Do. A Ord. Stk. .	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	71
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	—	4¾—4⅞
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	75
560,000	"	"	5½	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	12½
16,3 7,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord. . .	98—102	4 15 6	75—76*
2,600,000	"	"	3½	3½	3½ p.c. max. .	76—79	4 8 7	60¾*
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10	..
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	61—61¼
130,000	"	"	10	10	10 p.c. Bonds .	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¼	Ilford A and C . . .	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6	64½—65
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
					B	146—148	4 14 7	
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	[illegible]	6/-	Monte Video, Ltd. . .	11½—12	6 13 4	..
1,875,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅔	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7½—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	4 19 3	..
100,000	50	"	12	60/-	Do. C . .	118—121	4 19 2	..
52,000	50	"	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 13 4	2—2⅛
499,960	5	June 26	5	2/6	" 5 p.c. Pref. .	4¾—5	5 0 0	3$\frac{9}{16}$—3¾
521,600	100	June 2	4	4	" 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	"	"	10	10	Do. B	222—224	4 9 3	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75½—76*
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
224,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
187,558	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	.
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c. .	135—138	5 8 8	..
782,275	"	"	6	6	B 3½ p.c. .	115—117	5 2 7	..
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/3	55/1½	" C 3½ p.c.	110—115	5 2 0	..
852,000	"	"	6⅛	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	"	"	6⅝	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

* Ex. Div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Works Engineer and Manager. Cannock, &c., Gas Company. Applications by Feb. 28.
Manager (Small Works). No. 6158.
Rental Clerk and Collector. Walton-on-Thames Gas Company.
Clerk and Collector. Paignton Gas Company.
Clerk. No. 6156.
Main and Service Layer. Abercarn Gas Works.

Appointments Wanted.

Lady Demonstrator and Lecturer. No. 6157.

Plant, &c. (Second Hand), for Sale.

Denmar Rubber Bags. Dublin Gas Works.
Scrubber. No. 6151.

Meetings.

Hornsey Gas Company. No. 5, Great Winchester Street, E.C. March 10. 3.30 o'clock.

Sale of Stock.

Aldershot Gas, &c., Company. London Mart. March 14.

TENDERS FOR

Coal.

Darwen Gas Department. Tenders by March 4.
Eastbourne Gas Company. Tenders by Feb. 24.

Cookers.

Plymouth Corporation. Tenders by Feb. 26.

Fire-Clay Goods.

Loughborough Gas Department.
Rhondda Gas and Water Department. Tenders by March 1.
Wombwell Gas and Water Department. Tenders by March 3.

General Stores (Compo. Pipe, Lead, Cocks and Brass Goods, Paints, Sulphuric Acid, Lime, Ironmongery, &c.)

Plymouth Corporation. Tenders by Feb. 26.
Rhondda Gas and Water Department. Tenders by March 1.

Lighting Goods, &c.

Plymouth Corporation. Tenders by Feb. 26.

Meters.

Plymouth Corporation. Tenders by Feb. 26.
Rhondda Gas and Water Department. Tenders by March 1.

Pipes.

Plymouth Corporation. Tenders by Feb. 26.
Rhondda Gas and Water Department. Tenders by March 1.

JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST, LONDON.

VOL. CXXXIII., No. 2755.] TUESDAY, FEBRUARY 29, 1916. [68TH YEAR.

EDITORIAL NOTES.

Coal Contracts and the Price Limitation Act.

FROM more than one quarter, we have received communications regarding the statement made by the Chairman of the Commercial Gas Company (Mr. W. G. Bradshaw), at the recent meeting of the proprietors, to the effect that the Directors had "actually contracted for a substantial "quantity [of coal] at a price considerably less than the "limit fixed by the Price of Coal (Limitation) Act, 1915." To this statement additional emphasis and prominence were given by an editorial reference in last week's issue. Those who have made communication with us upon the subject regard the statement as a remarkable one; and we have been asked what it really means, because, under the conditions generally ruling at the present time in the coal market it seems inconceivable that a contract could have been entered into for similar quality coals, in similar quantities, at a lower basis price than is provided by a contract entered into during the year ending on June 30, 1914. As a matter of fact, it is pointed out that the statement is altogether contrary to the experience of buyers who have been in the market for contract supplies, or who are in the market at the present time; and to them it is naturally strange if the Commercial Gas Company have been awarded preferential terms by any coal owners. It is, of course, impossible for us to go behind Mr. Bradshaw's words, and offer any explanation; but, as the matter has received such publicity, and we are assured is giving rise to some trouble and confusion between gas undertakings and their contractors, and is causing some inconvenience in the matter of negotiating coal supplies for the next twelve months, we hope that Mr. Bradshaw will, through our columns, make a statement which will remove all doubt regarding the matter.

Of course, the literal meaning of the original statement as made to the Commercial proprietors is that for "coal of "the same description, sold in similar quantities, and under "similar conditions affecting the sale at the pit's mouth at "the same coal mine," as was contracted for in the twelve months ending June, 1914, is being sold at a lower price per ton than then, *plus* the standard figure of 4s. Other buyers are told by colliery owners that they are purchasing coal as cheaply as anyone else, and that there must be something not disclosed in Mr. Bradshaw's statement which would explain it, either due to the nature of the interpretation given to section 1 of the Act, or to the manner of calculating the basis price. The impression in one quarter is that the asserted lower price per ton is due more to calculation than interpretation. For example, by taking the prices for 1914 and uniting them with the prices for another year, the price now being paid can be made to appear below the average of those years, and therefore below the price fixed by the Limitation Act. Another suggestion is that explanation might be found in the manner that the contracts are being dealt with. Was one contract for similar coal taken in fixing the basis price, or was the average of a number of contracts adopted? There we leave the matter, trusting that in our next issue an explanation will appear from Mr. Bradshaw.

The Gas Engineer—Prophecy, Foresight, and Position.

WE are living in times when the very best there is in a man is required of him. There is talk in tales of the "good "old days," when things are said to have been very comfortable and very easy-going, and when everybody enjoyed life, and was on exceedingly good terms with everybody else. The printed words and the actual facts may not have altogether truthful coincidence—at any rate, there is doubt when we apply to the then conditions the test supplied by the remarkable growth in later years of the conveniences of life, which are now regarded as being indispensable to human comfort and pleasure. There were also, in perhaps the comfortable and easy-going sense, "good old days" for the gas engineer. But simultaneously with the progress of conveniences and improvement in general living conditions, and advances in the methods of doing the work of the world, and enhancing productivity on all hands, the claims upon the individual have become more strenuous; and, in the competition in every walk of life and in every part of the world's affairs, the strenuousness is becoming, in normal circumstances, more and more intense. This was realized and spoken of before the war; and the best of thinkers were counselling preparation by every individual for the still more arduous times which would come through ordinary progress and development. Then the war broke in upon the normal conditions, interrupted them, and cast us and all our affairs and interests into a mass of irregularity of which no conception could have been fashioned in our minds. We repeat, we are living in times when the very best that there is in a man is required of him; and this applies to the gas engineer in common with others. Perhaps it might with truth be said that it applies to the gas engineer in excess of many others who hold responsible positions in the world's work; for the gas engineer has not only to conduct with the maximum possible efficiency the public service of gas supply, and look after the subsidiary products of gas manufacture, but he has to perform these duties under circumstances for which no precedent can be found, and circumstances that are the most refractory and hostile to the rendering of service in the most effective manner. Not only are the usual obligations upon him extraordinarily heavy, but he has to shoulder new responsibilities in connection with the provision of materials for the war; and simultaneously he must look well forward, unless he has no care as to the future of his concern.

In his Presidential Address on Saturday to the Manchester District Institution of Gas Engineers, Mr. E. A. Harman had a good deal to say about the gas engineer, and his part in administrative and engineering policy. The opinions expressed were broad and sound. Perhaps there is no class of men whose qualifications better enable them to deal more effectively than engineers with a complex situation such as the present, together with its possible bearings and effects, in view of the fact that, in all phases of the work of the latter, they have not only to look to the present but to the future. In looking to the future, we must distinguish between that which is prophecy and that which is foresight. No one deprecates attempts at prophecy more than we do; and no one more deprecates the neglect of the exercise of the best possible degree of human foresight. Right in the forefront of his address, Mr. Harman says: "There are not "wanting people who will tell us what will happen after "the war is over; but their prophecies may be discarded." No one can say positively what will happen after the war; nevertheless it is the business of each one to look forward. Though he does not prophesy, it is the part, it is the duty, of the engineer to measure the future in a discriminating fashion on the basis of prevailing conditions. One of the most important branches of his work in design is to provide not only for present requirements, but to make assessment of those within a reasonable distance in the future; so that they, too, may be met on the most economical and efficient lines, subject, of course, to unforeseen developments which may affect the position. Thus we suggest that care be taken not to misapply the term prophecy to foresight, which latter attribute in the gas engineer and manager is to-day one of incalculable value. The gas engineer who can best and reasonably assess future conditions by the guidance of current circumstances, and make provision accordingly, is the gas engineer who will show to greatest advantage when the war conditions have accumulated to the point of maximum severity, and when the new after-war conditions come upon his undertaking. Foresight, we repeat, is an indispensable qualification in the engineer; and it is a cardinal be continued by gas undertakings, perhaps on a limited scale, after the war. If this is so, then the hopes of the motor car users will be fulfilled.

Coal and Coke Exports.

The returns as to the exports of coal in January show that the Coal Exports Committee continued their discriminatory control over the coal sent out of the country. The month's shipments amounted to 3,171,200 tons, compared with 3,612,963 tons in January, 1915—a reduction of 441,763 tons. In January, 1914, 5,794,770 tons were exported; so that in contrast last month was down 2,623,570 tons. France was still buying heavily; but Italy—this is not surprising in view of the weight of freights—was receding in her requirements. Its purchases were less by 360,000 tons odd than in January, 1914, and about 45,000 tons less than in January, 1915. The exports of coke last month amounted to 112,809 tons; in January, 1915, to 92,597 tons; in January, 1914, to 124,256 tons.

PERSONAL.

Mr. A. M. Paddon, M.Inst.C.E., has been appointed Chairman of the Hornsey Gas Company, in succession to the late Sir Hugh Owen, G.C.B., and the vacancy on the Board has been filled by the selection of Mr. Frank H. Jones, M.Inst.C.E.

Much sympathy will be felt with Mr. William Garton, the Chief Accountant to the Nottingham Corporation Gas Committee, at the bereavement he has sustained by the death at the front of his grandson, Mr. Will Garton, of the 10th Sherwood Foresters. Deceased was among the first recruits in Nottingham for Kitchener's Army. He had been in the service of the Nottingham Water Committee.

Major Arthur Bray, of the Royal Engineers, who has been awarded the French Croix de Chevalier of the Legion of Honour, is the head of the firm of Messrs. George Bray and Co., of Leeds. He joined the Leeds section of the R.E. in 1902, and went to the Dardanelles last April, where he was put in command of the General Headquarters Signal Company. He was invalided home last August, and is at present recuperating in Devonshire.

OBITUARY.

Sir G. Laurence Gomme, whose death occurred last week, was for many years well known in connection with the work of the London County Council, into whose service he passed from that of the Metropolitan Board of Works. A quarter-of-a-century ago. he was appointed Statistical Officer to the Council; and in 1900 he was appointed Clerk. The latter position he retained till 1914, when he retired, on medical advice. Deceased was an acknowledged authority on London from the historical point of view.

Another member of the automatic meter staff—the third in the department—of the Manchester Corporation Gas Department has just fallen in the war. This is Corporal Webster, who had fourteen years' experience in the stores and cash collecting branches, and who was held in high esteem by all his colleagues. He was killed in action in France on the 10th inst., while serving with the 18th Battalion Manchester Regiment. Altogether 620 employees of the Gas Department have so far volunteered for service with the King's Forces; the casualties being as follows: 16 killed, 29 wounded, 3 missing, and 4 prisoners of war—total 52.

A great loss has been sustained by the Tottenham District Light, Heat, and Power Company through the death, which took place last week, of the Secretary, Mr. E. Topley, who had, by his cheery nature, lovable disposition, and splendid patience under many years of anxiety and ill-health, so much endeared himself to everyone that he will be greatly missed for a long time to come. In fact, in the course of a sympathetic letter, Mr. A. E. Broadberry (the Engineer of the Company) says that during the whole course of their business connection, he found working with Mr. Topley was an absolute joy. Deceased had held the position of Secretary at Tottenham since 1907—having been promoted from the position of Assistant-Secretary on Mr. James Randall's retirement in that year. He was the younger son of Mr. William Topley, of Woolwich, and spent the first few years of his working life at Somerset House, in a department of the Inland Revenue. But this employment did not afford sufficient scope for his energies, and he resigned to join in business his father and elder brother. The eldest brother was Mr. W. Topley, F.R.S., of the Geological Survey, father of Mr. William W. Topley, Secretary of the Croydon Gas Company. For thirty years Mr. Topley led a strenuous life in that business, succeeded by a few years with another firm, after which (some ten years ago) he entered the service of the Tottenham Company. His only surviving son is Dr. W. W. C. Topley, of Harley Street.

The next meeting of the Coke-Oven Managers' Association will be held at Leeds University on the 25th prox, when Professor John W. Cobb will lecture on "Refractory Materials and Salty Coals."

ELECTRICITY SUPPLY MEMORANDA.

There is no occasion to gloat over the war misfortunes of electricity supply companies. Gas undertakings have quite enough of their own to bear; and their administrators are sympathetic people. But we cannot help remembering now, as tales of diminished electricity profits and reduced dividends are unfolded, and as we see the price for current being further raised practically everywhere, how some of our bosom electrical friends made, in the early days of the war, strange comparisons of the relative increases in the prices of gas and electricity—of course, on paper to the advantage of electricity supply, without taking into account the not unimportant factor of value received for money expended. Now a different tale could be told by them. Last week we showed how the net earnings and the dividend paid by the St. James' and Pall Mall Electric Light Company had had a down-hill slip. Other accounts have since been published; among them those of the Westminster Electric Supply Corporation. In 1912, the available balance of this concern was £36,187; in 1915, £23,518. The dividend in 1912 was 10 per cent.; in 1915, 7 per cent. The carry-forward in 1912 was £7703; in 1915, £1518. These are substantial differences. The Chelsea Company are proposing a dividend of 4 per cent., as compared with 5 per cent. in 1914. When the dividends of electricity companies are compared with those of gas companies, it must not be forgotten by our electrical friends that, in most cases, the stocks of gas companies have been converted on (variously) from 3½ to 5 per cent. bases, with the sliding-scale applying. One other point. In addressing the shareholders at the meeting of the St. James' and Pall Mall Company (whose reduced profits and dividend, as mentioned above, were noticed last week), Mr. Walter Leaf remarked: "With regard to the future, I shall make no prophecy of any sort. We are entirely dependent upon the course of the war. If the war stopped to-morrow, I have no doubt we should soon step back into our previous prosperity; but so long as the war continues, there is no obvious reason why profits should improve." As to what would happen if the war stopped to-morrow, Mr. Leaf is perhaps a little too optimistic. The costs of coal, materials, goods, transport, labour, and taxes are not going to tumble back swiftly into their former state; and these are the expenses that govern electrical profits.

The Slide Down Hill.

Allusion was recently made to the proposals at Brighton whereby existing charges for the supply of electricity by the Corporation Electricity Department were to be abolished, and flat-rates sliding downwards according to quantity were to be adopted. The recommendations of the Committee (which were referred back to them by the Council) were that to all users other than power consumers the charge should be for the first 1000 units 5½d. per unit, with a reduction of ½d. per unit for each 1000 units beyond, until for all consumption over 4000 units 3½d. per unit should be paid. Prepayment consumers within the borough were to be charged 5½d. per unit; the unfortunate ones outside the borough, 6½d. There was in the Council some objection to the charge, on the ground that the large consumers would receive undue preferential consideration; there was also criticism of the fact that power consumers were to be let off scot-free. The reference back has not caused the Electricity Committee to alter their determination as to the lighting consumers; but they have decided that the flat-rate for electricity supplied for power should be increased from 1¼d. to 1½d. per unit for the first 2000 units, and for larger use 1¼d. per unit. This alteration compares with an advance from 1·35d. to 1·4d. per unit for tramway purposes; so that the ordinary power consumer above 2000 units is better off than the tramways. No alteration is proposed in the 2d. per unit charged for street lighting. Then it will be remembered that there was some discussion as to the Electricity Committee being allowed from the district fund a sum of £2000 per annum for interest and sinking fund charges in respect of the proportion of generating plant, including land, buildings, trunk mains, and machinery required for street lighting, in regard to which the unextinguished debt is estimated at £25,000. This was a very artful move; the Gas Company receive no such consideration. The Electricity Department would not, however, voluntarily relinquish the whole of their claim, but reduced it to £1250 per annum, credit being given against the contribution for all current used for street lighting. When the reconsidered report came before the Council, it was made clear with unblushing candour that the Electricity Committee are opportunists of the first water. They are taking advantage of the war to get out of a tariff muddle. The existing conditions were spoken of as a "pandemonium of tariffs," and as "inequalities;" and Mr. Lintott, who moved the adoption of the report, "urged the Council to take the opportunity of doing away once and for all with the endless anomalies and the complicated scale of charges they had suffered from so long." The upshot was that the proposed lighting tariff was adopted, with the modification that the minimum charge was fixed at 4d. per unit for 4000 units and upwards; but the question of the £1250 contribution towards loan charges in connection with the street lighting was referred back. The Finance Committee have the point under consideration, so that possibly more may be heard of it.

The Brighton Charges.

Of Unknown and Mysterious Origin. Fires of unknown and mysterious origin seem to have greatly increased in number since electricity has been introduced into our daily life. But even if an electrical main is found to be burned and all other testimony points to a fire having had electrical birth, one must not ask a Court of Law to accept these things as sufficient evidence of electrical misdoing. That is what Mr. Edward Price, the proprietor of the Royal Laundry, at Shepherd's Bush, has found. He had a fire on his premises, which he alleged to be due to the electrical installation of the Hammersmith Borough Council; but the Council disclaimed all liability. The fire broke out in the laundry sorting-room, where the service-main entered the fuse-box and meters, which were connected at a point where the plaintiff's own wires began. The issue was, Did the fire commence on the defendants' or the plaintiff's side of the fuse-box? Mr. Justice Rowlatt was not satisfied that the evidence showed where the fire originated; and he felt bound to wash his hands of the whole affair by saying: "It is a fire which must remain, in my judgment, one of unknown and mysterious origin. I know quite well where there is apparently no external cause of a fire, and there is electricity in the place, and the service-main is found to be burned, that one is apt to say that it must have been the electrical current which started the fire. But this is only guessing; and I do not think that I am entitled to adopt that intellectual process." Sometimes common sense, and not "guessing," is applied in such cases.

Occasional Cessations. There are many cessations of electrical current that are not reported in the Press; but good representative samples do find their way into public notice. It really matters very little to a local concern whether or not an occurrence of the kind gets "into print;" but there seems to be a deeply rooted objection on the part of electrical engineers and members of electricity committees to seeing the black and white record staring them in the face. The fact of the collapse they apparently regard as sufficient punishment; for throughout the area of affected supply, the electricity consumers know what has happened, and do not forget to talk about it. We have recently had the unpleasant task of calling attention to a number of electrical breakdowns; but among them we do not find chronicled certain happenings at Bristol. Perhaps these have been kept out of the local Press. However, at a recent meeting of the Council, there was some criticism of the "occasional cessation" of the supply of current. The pertinent inquiry was put to Alderman Pearson, the Chairman of the Electricity Committee, as to whether anything could be done to ensure a better and more reliable supply of current. The Alderman started off by referring to the loss of efficient hands, and to the inefficiency of the new hands; and then a little later it was learned from his remarks that "two recent accidents had occurred through machines burning out." There was not much consolation to be extracted from Alderman Pearson; he has resigned himself to the fact that "nothing can stop occasional accidents of this character." Those who are weighing-up the consequences of adopting electricity will bear this in mind. At Hampstead on Dec. 15, there was a breakdown of a 1000 KW. turbo-alternator through an open circuit occurring in the shunt-windings of the exciter. It appears that, on switching-out the machine on the high-tension main switchboard, the switch failed to break the circuit. Results: The switch was entirely burnt out; a fire was caused on the main switchboard; the switchboard has been condemned as being of obsolete pattern; and an urgent order has been despatched for a modern one.

Raid Warnings. The electricity consumers of Manchester are while the war lasts to live in nervous anticipation of evil. In those electrically lighted houses where the occupants suffer from the fear of Zeppelins, the evening will be spent in watching the electric lamps for the five to ten minutes' fit of spasms to which they are to be subject when Zeppelins are reported. In the event of air raids, the supply of electricity is to be interrupted; and, as it is fit and proper that coming events should cast their shadows before them, the impending interruption of supply is to be notified by alternately raising and lowering the pressure several times for a period of five to ten minutes before the complete shutting-down of the power house. The electricity consumers will have an enjoyable time while the signalling is proceeding, and afterwards while sitting in the dark, or in the effulgence shed by a candle, listening for the dreaded bombs to drop.

Tragic Results of Amateur Work. On previous occasions, people have had unhappy endings to their careers in electric-baths owing to shock. A 16-year-old lad, named Roper, met with his death the other day, at his parents' house at Sheffield, through an electric shock (the voltage was about 200) owing to an electric lamp falling into the water in which he was having a bath, and causing it to "become alive." From the water through the body of the bather the circuit was completed (it was thought) by going through the taps at the end of the bath. The lamp, it was stated, was fixed by the deceased's brother, who was an amateur at electrical work. At the inquest, the Coroner (Mr. J. Kenyon Parkes) commented on the fact that there did not appear to be any regulations to prevent people making unauthorized connections to electric light fittings. He thought this tragic incident should be a lesson to people not to interfere with electrical work.

Enemy Goods. The British electricity supply industry has notoriously been a devoted patron of what are now enemy countries. But it has relented; and there is a devout intention now to show better and more patriotic behaviour in future. The Association of Municipal Electrical Engineers have passed a resolution recommending that, as a means of avoiding the possibility of purchasing articles of alien enemy manufacture, the Government should compile and publish an authoritative list of the firms concerned in the supply of these goods. Probably there are not many firms here engaged in such supply to-day, but there may be several of them who will be after the war. Perhaps the resolution is intended to be retrospective; the list comprising those firms who were engaged in the sale of enemy goods before the war. If this is the case, then, in view of the shortage of paper, and the threatened still greater shortage, it would be an economy to adopt the course of printing a list of those firms who were not prior to the war trafficking in goods made in the countries with which we have now rather a serious disagreement. The Association of Municipal Electrical Engineers should alter their resolution accordingly.

Dublin Electricity Affairs. It is a long time since we had anything to say in the "Memoranda" about electric affairs in Dublin; but thoughts now revert to those times when there were innumerable rows in the Council over the big "white elephant" that the city had in their electricity undertaking. Then when the Chairman of the Electricity Committee was able to proudly announce that the concern had financially "turned the corner," the gratification became great. But, in some quarters, there were doubts as to the validity of the claim when all the financial aspects were marshalled and examined. However, with all the pushing since, there has not been much progress past "the corner;" and again there is dissatisfaction. A short time ago, a Special Investigation Committee were appointed by the Corporation to look into the affairs of the Department; and Mr. P. Walter d'Alton, M.Inst.C.E., M.Inst.E.E., was called in to report upon the concern. He does not think much of what he found. Administration is complicated; charges for energy for private supply are unduly high; the number of men employed at the Pigeon House station could be reduced by the use of more modern machinery; the salary and wages in the public lighting department appear to be out of proportion to the revenue; the cost of the secretarial and managerial department is high; the system of coal supply wants carefully overhauling; further capital must be expended on the generating station; the returns of the units generated are unreliable, owing to the defective and dirty condition of the meters; some of the engines are obsolete and extravagant; the condensers are now, and have been for some time, ineffective; and he refers to the boiler-house as being rather an exhibition than the serious centre of a generating station. This seems all very bad, until confusion is generated in the mind by reading the comments upon the report made by Mr. Fred. Allan, the Secretary and Manager, and Mr. Mark Ruddle, the Engineer. The former alleges that Mr. d'Alton did not once visit the Sales Office; and as to the rates charged for private supply, those who had changed from gas to electricity for either light or power had in every case saved money. This is remarkable. Nevertheless, Mr. d'Alton, we gather from Mr. Allan's report, seems to think the managerial part of the secretarial department might be wiped out altogether. This, of course, Mr. Allan resents—not seeing why his "job" should be given an unhappy despatch, or even be reduced in any way. Mr. Ruddle does not think the charges are high, having regard to the price of gas and the cost of steam-raising fuel. He gives the interesting information that during the year ended March, 1915, 3,844,800 units sold for power purposes produced an income of £20,024, while 4,261,200 units sold for private lighting produced £72,300—that is to say, of the total units sold for private lighting and power, 53 per cent. sold for lighting produced 78 per cent. of the total income; while 47 per cent. sold for power produced 22 per cent. of the total income. Mr. Laurence J. Kettle is the Deputy Electrical Engineer; and he also has a slap at Mr. d'Alton, and leaves his mark. The expert suggested that the new Oerlikon 3000 KW. engine at the power station should have been run through practically the whole of 1912-13. Mr. Kettle's comment leaves no manner of doubt as to his view of Mr. d'Alton's judgment upon this point. In the opinion of Mr. Kettle, it would have been "sheer lunacy" to have gambled with the safety of the supply in the "irresponsible manner" suggested. We hope the Special Investigation Committee will be able to arrive at a sane conclusion from the four reports. To do this, if they are all laymen in electrical matters they have their work cut out.

Prohibited Exports.—By an Order in Council made on the 23rd inst., the exportation was prohibited to all destinations of oxide and salts of cerium, and cerium and its alloys (except ferro-cerium). The exportation of ferro-cerium is prohibited to all destinations abroad other than the various British Possessions and Protectorates.

ESTIMATION OF BENZOL IN COAL GAS.

In its issue for Feb. 20 the "Journal des Usines à Gaz" takes up the question of the methods of estimating benzol in coal gas, in reference to the recent note by Dr. C. Neubeck, the Chemist to the Hibernia Westphalian mines, wherein the German author described his method as a modification of that of Sainte-Claire Deville, and both more convenient and exact than the latter's. This claim leads our French contemporary to review the methods which have been employed in France for measuring the benzol content of gas. The article, of which the following is a translation, while refuting the claims of Dr. Neubeck, incidentally records the comparative value of methods for estimating benzol which have been thoroughly tested in France for many years past.

From 1881 the method employed by the experimental department of the Paris Gas Company was to determine the weight, P, of benzol which condensed from one cubic metre of gas at the temperature (− 21° C.) of a mixture of ice and salt. The gas, after passing the cooling chamber, then contained only the benzol required to saturate one cubic metre of gas at − 21° C., a quantity which was taken to be susceptible to very slight variations. Calling this constant quantity K, the total content of benzol in one cubic metre of gas is $K + P$. Variations in this total figure, in examining different gases, were taken as due almost entirely to variations in P. In 1880, the use of methyl chloride allowed of a temperature between − 70° C. and − 80° C. being obtained. Experiments on air charged with a known weight of benzene and on eighteen samples of coal gas of different qualities, showed that at − 70° C. the vapour tension of benzol is *nil;* also the quantity K (benzol left in gas at − 21° C.) is, as was supposed, subject to slight variation, and can be taken at 23·5 grammes per cubic metre—a figure agreeing almost exactly with Regnault's measurements of the vapour tension of pure benzene at − 21° C.

From 1884, the analytical reports of the Villette experimental works recorded not only the quantity, P, actually condensed at −21° C., but $P + 23{\cdot}5$ as "benzol per cubic metre of gas." This benzol vapour was further taken as having the same density as a mixture of three-quarters benzene and one-quarter toluene—bringing the weight of 1 litre to 3·73 grammes; and so the volume percentage of benzol vapour in the gas was obtained by dividing $P + 23{\cdot}5$ by 3·73.

In opposition to the statement by Dr. Neubeck, actual condensation at − 21° C. takes place very readily. Since 1884, the determinations made daily at the Paris experimental works have reached a total of from 15,000 to 20,000. The method is obviously inexact when the benzol falls below 23·5 grammes per cubic metre. Such a low content, however, is never met with in ordinary working; it occurs only in gas taken at the end of a charge, or if there has been a special removal of benzol. It was on this account that the experimental department of the Paris Company, in studying in 1891 the variations in the benzol content of gas produced at different stages of the distillation, employed a low temperature in the condensation of the benzol from the gas under test.

Since the previous low-temperature tests had been made in 1884, liquid carbonic acid had come into industrial use, and the method now re-invented by Dr. Neubeck, of using a mixture of solid carbon dioxide and ether, was employed. As regards accuracy, the results were very good; and the idea was entertained of using the new method regularly in place of the old one. Comparative tests of both methods on all the samples of gas examined in three months showed, however, that the results differed by little more than the negligible amount of 3 to 4 per cent. At this time, the Dewar vacuum flask was not available; and the maintenance of the carbonic-ether mixture for the necessary time called for much supervision. Hence it was decided that the slight gain in accuracy was not enough to compensate for the greater labour and expenditure of time.

In 1913, the matter came up again on the publication of Lebeau and Damien's work on the analysis of gas by condensation at the temperature of liquid air. A series of experiments was planned, among them an examination of the measurements of benzol in gas by cooling with carbonic snow, but according to a much simpler method made possible by the use of the Dewar flask. The war has greatly interfered with the full course of these researches; but the part relating to the estimation of benzol had to be carried out when, towards the end of 1915, it became necessary to control the extraction of benzol on the large scale from gas for the manufacture of explosives. The method adopted, and in use at present, was exactly that of 1891, save for the employment of the Dewar flask.

For an ordinary test, a very small refrigerating tube is contained in a Dewar flask of cylindrical form, measuring 35 mm. [1⅜ inches] in diameter by 100 mm. [4 inches] deep. From 25 to 30 litres of gas are passed at the rate of about 10 litres per hour—a displacement apparatus being used for its measurement. If the object is to collect considerable quantities of benzol for examination by fractional distillation, a much larger apparatus is used, involving a correspondingly greater consumption of carbonic acid. In this case, it is advisable to place in front of the carbonic refrigerator one of ice and salt. A preliminary fractionation of the condensed liquid is thus obtained, and this facilitates the further analysis.

The foregoing notes have intentionally been confined to the means employed for ensuring accuracy in the tests without recourse to the needless complications introduced by Dr. Neubeck. A future occasion on which the latter can be examined may present itself. Meanwhile, concludes the author of the article, it is sufficient to point to the process as an example of the rapacity with which German chemists coolly appropriate the authorship of inventions and ideas which become known to them from the works of scientific men in other countries but which, in their high estimation of themselves, they affect to ignore.

BRITISH INDUSTRIES FAIR.

Visitors during last week and this week to the Victoria and Albert Museum, South Kensington, where the British Industries Fair is being held, will doubtless approve of the reply given by the President of the Board of Trade to a question some days ago in the House of Commons—that it is the present intention of the Board to hold a fair of this character in the spring of each year. The one now opened is the second of the series; and it was arranged at the unanimous request of last year's exhibitors. The trades included were limited to very few, in order that the manufacture of munitions and other Government supplies should in no way be interfered with. But in spite of this there was a large demand for space. Admission is by invitation, which is, of course, confined to traders; and the attendance is good, with (judging from what one sees) a very fair number of inquiries. It is quite likely the results from a business point of view may not in all cases be of the same degree of excellence; for some "lines" will naturally be more in demand than others. But, anyway, taking the exhibits as a proof of what British manufacturers can do in the particular trades represented, there is ample ground for satisfaction on the part of all patriotic people. The visitor can hardly help feeling that, with proper encouragement, firms in this country will, in many directions, be quite as well able as others to supply requirements for the meeting of which it has too frequently been the custom to look elsewhere. The Victoria and Albert Museum is not the most convenient possible place for such a display, as the exhibits are somewhat scattered, and in some cases the passageways are rather limited; but it is the best accommodation that was available, and the Board of Trade have minimized confusion by issuing with the catalogue a plan showing the arrangement of the stalls.

The glass section, in quality of workmanship and variety of articles shown, is in no way behind the others; but though there are to be seen many excellent patterns of shades, &c., this class of goods by no means predominates. Scarcity of labour and pressure of work upon those who are available, prevents the glass firms from extending their activities as they would wish to do; but this is a matter that will in time right itself. The catalogue names the following exhibitors under the heading of "Lighting Glass:" Messrs. A. M. Allan and Co., of Glasgow; Messrs. Burtles, Tate, and Co., of Manchester; Messrs. A. & J. Davies, Limited, of Stourbridge; Edinburgh and Leith Flint Glass Company, of Edinburgh; Glass Sundries, of London; Messrs. Greener and Co., of Sunderland; Messrs. Molineaux, Webb, and Co., Limited, of Ancoats, Manchester; New English Glass Manufacturers, Limited, of Tipton; Messrs. H. G. Richardson and Sons, of Stourbridge; Messrs. Stevens and Williams, Limited, of Brierley Hill; and Messrs. Stuart and Son, Limited, of Stourbridge. A branch which the Board of Trade point out provides an example of notable improvement on previous work is the preparation of laboratory glass. It seems that when, on the outbreak of war, the supplies of Jena glass were cut off, firms supplying laboratory glassware formed themselves into an association with the object of encouraging the turning out of ware equal to that of Jena, so as to meet the demand in this country. The Association drafted up a formula, which compared well with the Jena formula, and then induced glass manufacturing firms to undertake to make the new ware—the results obtained being quite satisfactory.

A High Temperature Refractory Brick.—Stating that very good results have been obtained at an American ironworks by the use of a novel form of patent metal-cased magnesite brick, the "Iron and Coal Trades Review" remarks that it seems rather strange that the heat resistance and durability of magnesite should be increased by covering blocks of that material with such a comparatively fusible substance as sheet iron. Careful tests, however, extending over a period of two years, appear to have demonstrated that blocks of this construction used for very large basic furnaces have shown a durability at least two-and-a-half times as great as that obtained under similar conditions from the best ordinary magnesite bricks. The external casings are made of sheet-iron or steel, No. 18 to 20 gauge, pressed into rectangular shapes with dimensions corresponding to the bricks usually employed. The metal casings are electro-welded or riveted along the joint; and both ends are left open. The moulds thus formed are packed with damp magnesite. These rectangular bricks may be built into the furnace dry. Suitable lengths of old boiler tubes, not more than 3 inches outside diameter and ⅛ inch thick, may be used in place of the rectangular casings. These pipe bricks, after being filled, require to be laid in a mortar of magnesite when being built-in. For filling the bricks Grecian magnesite is preferably used. The bricks or pipes have a melting point of about 3500° Fahr.

THE EVOLUTION OF THE MODERN CHARGING AND DISCHARGING MACHINE.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

No unit of plant in the equipment of the modern gas undertaking has made more rapid strides into favour during the past few years than has the electrically operated stoking machine, whose advent has been largely the means of sweeping away old prejudices and conservatisms and of marking the beginning of a new era in gas-works practice. It has been stated that the extended use of the overhead transporter and the mono-rail telpher has been largely responsible for the introduction of electric power into gas undertakings; and while this may be correct in a few isolated cases, there is little doubt that in the great majority of works employing electric power plant the decision to use an electrically driven stoking machine has been primarily responsible for the laying-down of such an installation.

In placing the most important unit of his plant under the electric drive, the modern gas engineer has shown a degree of impartiality and broad-mindedness which might well be emulated by the many carping critics who, in their biased enthusiasm for things electrical, have for years made themselves ridiculous in the Technical Press by their erratic attacks on every phase of the gas industry, and whose parrot-like cry, "Gas must go," has only lately been silenced by their unwilling recognition of the vital part which the gas industry is playing in the present war, and of the stern fact that the fate of their country practically depends upon the efforts of those industries whose characteristic is the production of bye-products which may be utilized for the manufacture of high explosive shells.

The electric motor, by reason of its characteristics, possesses advantages over practically every other type of power generator; and for no purpose is it more admirably adapted than for the operation of the machines forming the subject of this article. By its adoption the gas engineer demonstrates the fact that he has a wide grasp of the principles of the economic application of power and of those principles by which power, intelligently converted to a suitable form, may be economically applied over a large area of operations. He does not weaken the case for the gas-engine; rather does he strengthen it by the use of an actual piece of substantial evidence that, by the application of his own product, he can (as can any of his consumers) generate whatever current he needs at a much lower cost per unit than that at which his competitors could supply it from their mains.

Electricity cannot be manufactured, in the true sense of the word. Energy, latent or active, is always with us; and it is in our hands to apply it to the best advantage. We cannot make it; but we can change its form. If we can apply mechanical energy direct, there is no sense in converting it into electrical energy; but if, on the other hand, such conversion would enable us to transmit a given power over a given distance at a cheaper rate per B.H.P. hour than would be possible by employing a purely mechanical method of transmission, it becomes apparent that the most business-like method is to convert our power into electric energy and reconvert to its original form at the far end of our transmission line. By this system we have to face three sources of loss in power—namely: (1) The loss in the dynamo in the conversion of mechanical to electrical energy; (2) the loss in transmission of our power between the point of conversion and the point of application; (3) the loss at the point of application in converting the electrical energy back into mechanical energy.

In the operation of stoking machines the very nature of the machine and of its duties renders it imperative that the driving energy should be delivered to the machine in such a form as to be capable of conversion into mechanical energy with the least possible loss and the greatest attainable amount of simplicity. The modern stoking machine is the outcome of a vast amount of experience which has proved that these conditions can be most efficiently met by the generation of electrical power by means of a gas-engine, and by the use of a motor or motors on the machine itself for reconverting the electrical energy so generated into a mechanical form. The dynamo, transmission lines, and motor or motors, are merely so many connecting links between the shaft of the gas-engine and the stoking machine by whose means the mechanical power generated by the gas-engine is applied to the operation of the various motions of the machine; and while loss of power is unavoidable in any system of power transmission, experience has proved that the electrical transmission of power to such machines gives a degree of simplicity, efficiency, and flexibility afforded by no other system of power application.

For many years pneumatic and hydraulic power held the field for the operation of these machines, but latterly the application of the electric drive has become universal. The experience of all large engineering undertakings has proved that, properly applied, the electric drive may, so far as technical considerations are concerned, be advantageously applied to any machine; but in very few cases does it show to greater advantage than in that of the stoking machine. It is obviously impossible to deal with the many lines along which this machine has been developed and improved upon during the last few years; and in this article the writer proposes to deal largely with the development of the multiple motor machine, and with a few of the points by which the prospective purchaser may allow himself to be influenced in his choice of a machine.

The stoking machine has progressed along very much the same lines as the electric crane, in which machine it is now generally recognized that the expense of installing three or more motors is more than counterbalanced by the increased convenience of operation, the lower maintenance charges, and the elimination of expensive and power-wasting gearing. The expense of installing three motors, with their control gear, is not so great as may be supposed, as it must be remembered that this practice enables a large amount of expensive gearing to be dispensed with; while, further, the employment of such gearing constitutes a constant charge upon the plant, on account of the power expended in operating it.

Three motions have to be provided for in a machine of this class—namely: (1) The travelling motion for the traversing of the machine up and down in front of the retort-benches; (2) the elevating and lowering motion, for adjusting the vertical height of the inner frame to the particular tier of retorts with which it is intended to deal; (3) the stoking motion, in which designation is included the charging and discharging machinery in a machine of the combined type, or the fire element which carries out these two duties in the simultaneous type of machine.

As in the case of the electric crane, there was in the early stages of the development of this machine a tendency to use one motor for all three motions, and to engage it with whatever motion it was desired to operate by means of an elaborate lay-out of interconnecting gears and clutches. While the ingenuity displayed in the general lay-out of such gearing cannot but be admired, time has shown that most of this constructive skill might have been better applied in other directions. The problem of providing this interconnecting gearing becomes all the more complex when it is remembered that the inner frame of the machine on which the stoking gear (and sometimes the elevating and lowering gear) is situated has a vertical travel relative to the outer or main frame in which it is suspended, and mechanical compensating means have to be provided whereby the power from the single motor can be transmitted between the two frames at any point of the vertical travel of the inner frame. Mechanical means, of a sort, can be, and have been, provided; but the author has no hesitation in expressing the opinion that mechanical power can only be transmitted between the two frames at a considerable sacrifice in efficiency of this important motion, to say nothing of the host of undesirable mechanical complications which this arrangement entails.

The Development of Multi-Motor Machines.

The following are the reasons which have caused manufacturers to turn their attention to the development of the multi-motor machine.

A.—The more gearing is used the greater will be the backlash as the gearing becomes worn, and the greater will be the shock to the machine as a result of the speed which the motor will attain before the backlash is taken up.

It may be argued that a careful operator will so handle his controller as to take up all backlash before starting an operation. But the writer's experience is that such an operator is a *rara avis;* and the engineer who relies upon the care of the average operator to mask a weak point in a machine is leaning upon a rotten stick. Sheared keys, broken shafts, and stripped gears are commonly caused in this manner; and the immunity which the two or three motor machine enjoys from troubles of this kind is alone a sufficient reason for its extended adoption. The efficiency of a drive is inversely proportional to the amount of gearing used between the motor and its objective; and a single-motor machine is necessarily inefficient on all its motions on account of the interconnecting gearing. In the three-motor machine, on the other hand, there is no gearing whatever with the exception of that necessary to reduce the speed of the motors to the figure at which it is required to operate the different motions. As a consequence, the loss between the motors and their respective loads is reduced to a minimum.

B.—Whether a two or three motor machine is operated by a separate controller for each motor, or by a master controller and a change-over switch, the change from one motion to another is performed instantaneously, and without the delay which is unavoidable when heavy positive clutches have to be engaged and disengaged. The time needed by a single-motor machine to take up its position in front of a retort and move away from it after the charging or discharging (or combined) operation, is much longer than would be occupied by a machine fitted with an independent travelling motor, even assuming that the clutches of the former machine were in first-class condition.

In practice these clutches become clogged with accumulations of oil and coal dust, and are often very heavy and difficult to operate and the cause of much gas being wasted before the machine can get clear of the retort and allow the door to be closed. In order to grasp the heavy duty which falls upon the clutches of a single-motor machine, let us follow in detail the cycle of operations through which a single-motor simultaneous type of machine passes in handling a horizontal line of retorts, assuming that the setting of the retorts is sufficiently accurate to permit of the machine charging the entire line without having to alter its vertical adjustment—that is to say, without the necessity for the raising and lowering gear to be engaged.

Moving down from the berth to the first retort to be charged, the driver will perform the following cycle of operations: (*a*) Disengage the travelling gear, (*b*) engage the stoking gear, (*c*) disengage the stoking gear, (*d*) engage the travelling gear and move to second retort, where the same cycle of operations will be gone through. Summarizing, the travelling and stoking clutches have to be operated twice in dealing with each retort.

Assuming a house of sixteen benches, nine retorts to a bench, working on eight-hour charges in full work, this means that in the course of the twenty-four hours the travelling and the stoking clutches will be both disengaged and engaged 288 times; in other words, in this time there will be 1728 clutch operations, accompanied by 1728 shocks to the gearing of the machine, unless the operator happens to be an unusually careful class of man. This figure is based on the assumption that the operator brings his machine to a standstill accurately in front of each retort, and that there is no need for him to get back to his travelling gear to make a final adjustment when entering the mouthpiece. Miscalculations in this respect are of frequent occurrence; and it is far more likely that the stoking and travelling clutches would be operated from 2000 to 3000 times a day than the theoretically correct 1728 times. Neither do these figures take into account the using of the raising and elevating gear, which, in the case of badly lined-up settings, might easily account for a much larger number of clutch operations.

Such engagement and disengagement of positive clutches cannot in practice be carried out without edging the controller—that is to say, throwing the controller handle from one side to the other from its off position in order to either free the clutches or to line-up the respective halves prior to their engagement; and this edging is invariably accompanied by destructive arcing at the contact points of the fingers and on the barrel of the controller.

The author's experience with a one and a two motor machine of the same type is that, in the case of the latter, where edging the controller is unnecessary except to engage or disengage the raising and lowering gear, the maintenance of the controller (including time, replacements, and general attention) is only a fraction of that necessary with the single-motor machine. More harm seems to be done to the controller in a day's working where constant edging is essential than in a week's straightforward operation.

C.—The use of a single motor for all three motions makes it impossible to obtain that smoothness of working which is the greatest characteristic of the multi-motor machine; while the absence of interconnecting gearing in the latter considerably reduces the stock of spares which dictates of prudence render it advisable to keep. More electrical spares will have to be kept, it is true; but if the electrical gear is standardized so far as is consistent with efficiency, the money lying idle in the provision of such spares will be less than that expended in the provision of a safe stock of mechanical spares for a single-motor machine.

D.—The use of trains of interconnecting gearing between a single motor and the three different motions means that these three motions are rigidly tied together by a gearing the efficient operation of which depends entirely upon the maintenance of a perfect degree of alignment.

The various strains to which the frames of a stoking machine are subjected are too well known by readers of the "Journal" to need repetition here. The natural result of such strains is to cause distortion and the resultant misalignment of whatever gearing is carried by the particular member of the frame that happens to have been subjected to such a strain. Where the motions are tied together in the manner mentioned, the whole of the three motions are bound to be affected by such distortion; and while they will no doubt continue to operate, it is certain that their efficiency will be greatly diminished, and the degree of wear and depreciation will be enormously increased and frequent renewals will be necessary. Such conditions can be best avoided by the provision of an independent drive for each motion, by which means the effects of any strain to which the machine may be subjected will be confined to one only of the individual motions.

Various Makers' Preferences.

So far as the employment of one or more motors is concerned, the following particulars show the practice of the various makers in this respect.

A.—Name of Machine, "Drakes' Stoking Machine." Builders, Messrs. Drakes Limited, of Halifax.

The complete stoking machine manufactured by Messrs. Drakes is a combined charging and discharging machine; the two motions being entirely separate. The charging element or rotor is somewhat similar to the paddle of a steamship, but is divided on the vertical plane into two halves by a centre plate. The coal is fed into the rotor casing above and behind the centre, and is thrown into the retort by the centrifugal motion imparted to it by the paddles or shovels on the rotor, the speed of which can be varied according to the height of the charge which it is desired to place in the retort.

In this machine, as in the De Brouwer, the charging element does not enter the retort. Each of the four motions—charging, discharging, raising-lowering, and travelling—is operated by a separate controller, and is protected by a double pole circuit-breaker and fuses. Very complete arrangements are made to guard against the possibility of being absolutely stuck through the failure of the motors or control gear on the hoisting-lowering, discharging, and travelling motions, by the provision of means whereby these motions can be operated temporarily by hand in case of a mishap. If, for instance, the ram was in the retort at the moment of failure of the discharging motor, it could be wound out by hand; while in the case of the failure of either the travelling or hoisting-lowering motors, the machine could be adjusted by hand to deal with any retort. While the system of electrical protection employed renders these possibilities very remote indeed, the advisability and utility of such arrangements will be obvious. When breakdowns do occur, it is usually at the most awkward moment, and under conditions which are the reverse of ideal; and a machine the motions of which can be quickly manned for temporary hand operation possesses a distinct asset in such a feature.

B.—Name of Machine, "De Brouwer." Type: (1) Charging. (2) Discharging. (3) Combined stoker. Builders, Messrs. W. J. Jenkins and Co., of Retford.

The famous De-Brouwer machines are too well known to members of the gas industry to need much description. The three general types of the "all electric" class built by Messrs. Jenkins are: (1) The charging or projector machine, in which the "D.B." projecting apparatus is carried in a steel frame suspended within a travelling base; (2) the discharging or ram machine, likewise consisting of a travelling base in which is suspended an inner platform on which the ram or pushing element is mounted; and (3) the complete stoker, in which these two previous and separate types are combined on one platform in such a manner that the axis of operation of each apparatus lies in the same horizontal plane, thus enabling the machine to charge or discharge any one retort without altering its vertical adjustment.

In the case of all three types the travelling motor is mounted on the sill plate, and is used to operate both the travelling and the raising-lowering motions. The motor is coupled to a gear-box having at its side a chain drum to which are attached raising chains. The drum is operated by a spring-controlled clutch.

In the case of the projector and combined machines, a separate motor is, of course, used for the projector, and is of the shunt-wound type, having a speed regulation effected by field control of from 750 to 1500 revolutions per minute. The ram motion in both these machines is also served by a separate motor. The equipment is protected in the following manner: (1) The motors by a circuit-breaker. (2) The limits of raising and lowering the inner frame in all three types of machines is ensured by the provision of an automatic switch whose function is to cut off the supply of current to the raising-lowering and travelling motor in case these limits are exceeded. (3) A safety device is provided on the ram controller, the function of which is to automatically bring this controller to the off position upon the approach of the ram to the limits of its stroke, both outward and return.

The following table shows the ratings, types, and speeds of the motors used on the different motions of the three types of machines.

Type of Machine.	Motion.	Type of Motor.	B.H.P.	Speed.
Projector	Charging	Shunt	6	750–1500
Do.	Travelling and hoisting-lowering	Compound	7½	310
Discharging ram	Ram	Compound	11	350
Do.	Travelling and hoisting-lowering	Compound	11	350
Combined stoker	Charging	Shunt	6	750–1500
	Ram	Compound	11	350
	Travelling and hoisting-lowering	Compound	11	350

Note.—Each motor is operated by a separate controller.

C.—Name of Machine, "Fiddes-Aldridge Simultaneous Charging-Discharging Machine." Type, single motor. Builders, Messrs. Aldridge and Rankin, of Bath.

This machine is of the true "simultaneous" type, inasmuch as the dual operations of charging and discharging a retort are carried out by one stroke of the chain or fire element. The machine provides a striking example of the ingenuity that allows of a dual operation being carried out with the greatest efficiency and at the same time the least degree of mechanical complication. A crane type totally enclosed motor is fitted on the inner frame of the machine, and drives through positive clutches the three motions of charging-discharging, raising-lowering, and travelling. The gearing connecting these three motions is so arranged that when the operation calling for the greatest transmission of power (the charging-discharging motion) is in progress, the efficiency of transmission between the motor coupling and the actual retort element is the same as though a separate motor were employed for this duty; being undiminished by the presence of the gearing of the other motions.

The motor employed is of 13½ B.H.P., 480 R.P.M., one-third load factor, and is protected by a circuit-breaker and fuse box. An automatic device is also fitted to the machine to automatically cut off the current in the event of the charging-discharging chain being driven either forward into the retort or backward into the machine beyond the limits of safety.

D.—Name of Machine, "Fiddes-Aldridge Simultaneous Charging-Discharging Machine." Type, two-motor. Builders, Messrs. Aldridge and Rankin, of Bath.

This machine, which represents Messrs. Aldridge and Rankin's atest practice, follows closely on the lines of their single-motor stoker; the difference consisting in the provision of a separate motor for travelling. The 13½ B.H.P. crane motor, which in the single-motor machine was used for the operation of all three motions, is in the later machine used for charging-discharging and raising-lowering; the latter motion gear, as in the older type of machine, having no effect upon the efficiency of the former, and most important, operation. A series-wound crane motor is mounted on the near sill plate, and drives the travelling axles through a worm-gear box. A general description of this machine will be given in a later portion of this article, as also a series of tests carried out on a machine of this type in the No. 1 retort-house of the Plymouth and Stonehouse Gas Company.

E.—Name of Machine, "Guest-Gibbons Charging and Discharging Machine." Builders, Messrs. Gibbons Bros., of Dudley.

This machine is of the combined charging-discharging type, pushing out the coke in one movement and charging the retort in three stages. Each movement—hoisting-lowering, travelling, and charging-discharging—is operated by a separate motor; while each motor is controlled by a separate controller, and is protected by an overload automatic circuit-breaker. The motors are of the totally enclosed crane type, and of the following rated outputs: Charging-discharging (20-feet retorts), 15½ B.H.P. Charging-discharging (less than 20-feet retorts), 11 B.H.P. Travelling, 7½ B.H.P. Hoisting-lowering, 7½ B.H.P.

In this machine the travelling and the raising-lowering motor controllers are situated on the near sill plate; their spindles being extended vertically through a sliding operating wheel, which is always at the level of the operator's hand and which moves up and down with the vertical travel of the inner frame.

F.—Name of Machine, "Toogood Retort-Charging Machine." Type, Latest. Builders, Messrs. R. Dempster and Sons, of Elland, Yorks.

The outstanding feature of Messrs. Robert Dempster's latest stoking machine is that while the retort charging and discharging elements are quite separate as far as working is concerned, they both lie on the axis of the particular retort being dealt with; and it will be seen that this machine combines the merits of the independent machine with the undeniable advantage, in this respect, of the single-stroke machine. The machine can completely stoke a retort in one setting, or, in the event of a mishap to (say) the discharging gear, the charging element of the machine can continue to perform its duties, or *vice versâ*—a factor of moment, particularly in small works. The stoking operations—namely, charging and discharging—are grouped on one motor mounted on the suspended inner frame of the machine. The travelling and hoisting-lowering motions are performed by a second motor fitted on the main frame of the machine. Each motor has its own controller.

G.—Name of Machine, "West's Stoking Machine." Builders, West's Gas Improvement Company, of Manchester.

Two motors are used in the West machine—one for the stoking operations, mounted on the inner suspended frames, and a second motor for the travelling and raising-lowering motions fitted to the main frame of the machine. These two motors are operated by separate controllers. (*To be continued.*)

MANCHESTER INSTITUTION AND SULPHATE OF AMMONIA.

The General Committee of the Manchester District Institution of Gas Engineers, at a recent meeting, had before them the circular-letter from the Board of Agriculture and Fisheries, intimating the suspension of sulphate of ammonia exports, together with copies of letters from ammoniacal liquor contractors to some of the gas undertakings. After full consideration, it was resolved —"That the Council of the Institution of Gas Engineers be respectfully requested to take immediate steps to bring to the notice of the Board of Agriculture and Fisheries and of the Fertilizers' Committee, by deputation, if possible, the serious loss and difficulty which will at once accrue to the many undertakings now disposing of their crude liquor to contractors, by reason of the stoppage of exports and the notification from the contractors that they would only pay on prices they can obtain for such sales as they may be able to effect locally, while at the same time declining to guarantee the clearing of the present stocks of liquor and that to be made; and that they be requested also to take such steps as will enable the undertakings to avoid running these to waste down rivers, canals, or drains."

The resolution was promptly dealt with by the Council of the Institution of Gas Engineers, at whose request the members of the Manchester Institution have been asked by their Hon. Secretary (Mr. G. S. Frith, of Runcorn) to advise him if they are affected in any of the following ways, so that concrete cases may be reported to the Institution of Gas Engineers, for placing before the Board of Agriculture and Fisheries:—

1.—Where contractors have refused to remove the ammoniacal liquor from gas-works in consequence of the Government's action in suspending licences for the export of sulphate of ammonia.

2.—Where storage tanks have overflowed, and the ammoniacal liquor has been run to waste into drains, rivers, or lakes, in consequence of the failures of contractors to remove from works.

3.—Where sulphate of ammonia manufacturers have been unable to obtain supplies of acid, and the ammoniacal liquor has been run to waste.

4.—Copies of letters from contractors should also be forwarded when stating their case.

PHOTOMETERS DEPENDING ON PHYSICAL AND CHEMICAL METHODS.

The members of the Illuminating Engineering Society, with Mr. F. W. Goodenough in the chair, devoted last Tuesday evening to a discussion of future possibilities in the design of instruments for measuring illumination; special reference being made to photometers depending on physical and chemical methods. In preparation for the debate, a list of questions had been circulated; but sufficient for our purpose is a reference to two of them. One was as to what methods could be suggested for making illumination photometers of the ordinary type—those involving the use of a comparison source of light—more convenient for use by the general public. The other, and more important one, was as to what are the prospects of making a satisfactory instrument depending on the following physical or chemical methods: (*a*) The use of selenium or other photo-electric cells; (*b*) the use of thermopiles, or other instruments, for measuring radiation with or without a suitable solution or screen for absorbing the non-visible rays; (*c*) the difference in expansion of two metallic elements—one polished so as to reflect a maximum of visible light, the other coated with an absorbent matt-black material, but otherwise similar; and (*d*) the use of photographic methods such as the darkening of light-sensitive paper. Letters were read from Mr. A. P. Trotter, Mr. Haydn T. Harrison, Professor E. W. Marchant, Mr. P. J. Waldram, Professor Fery, and Dr. H. E. Ives (of the Physical Laboratory of the United Gas Improvement Company). Those who took part in the discussion were Mr. J. S. Dow, Mr. A. Cunnington, Mr. J. M. Frezise, Mr. J. W. T. Walsh (National Physical Laboratory), Professor Addenbrooke, Mr. W. R. Cooper, and the Chairman, and Mr. Leon Gaster wound up the discussion. The best part of two hours was spent over the questions. We are not going to report all that was said and read; but will assemble the principal points on the main subjects.

Existing Illumination Photometers.

Regarding the question of whether improvements can be effected in present illumination photometers of the ordinary type, Mr. Trotter does not think that the general public should be encouraged to amuse themselves with such instruments. Some experience is necessary; and intelligent precautions must be taken to secure useful results. In his opinion, instruments of the "Lumeter" and the "Luxometer" types, having wide ranges of adjustment, in addition to dark glasses, are bound to supersede older instruments. On the other hand, Mr. Harrison does not appear to consider that photometers for the general public is outside the scope of practical politics, as he suggests that such photometers should not embody the use of an eye-piece; seeing that few people can accustom themselves to work with one eye as correctly as they can do when taking a general view of a screen with both eyes. Professor Marchant considers that the Trotter illumination meter and the "Lumeter" are both quite convenient and simple. The practical difficulty that he finds is in keeping the battery in good order. When, as often happens, the instrument is not used for comparatively long periods, it is always necessary to employ some form of volt meter; and he suggested that this might be fitted to the instrument, together with some curve tables by which the readings of the instrument could be corrected for variations in lamp voltage. Mr. Dow stated that the point had been considered in connection with illumination photometers. It struck him, however, that if a volt meter is used it must be a very good one; otherwise it would be very misleading. Professor Marchant suggested additional structural details (as did Mr. Cunnington later) for improving the usefulness of this form of instrument; one suggestion being that it might be possible to devise some mechanical device whereby the readings could be automatically corrected for variations in battery pressure. For accurate comparisons of illumination, the same contributor has found nothing better than the Lummer-Brodhun photometer. Even with lights of different colours, he has found that, with practice, it gives excellent results—results far better than he has been able to obtain with a "Flicker" photometer. Mr. Cunnington thinks in some quarters there is a tendency to exaggerate the difficulties with illumination photometers; but with practice a lot of the difficulties disappear. He also described an illumination gauge which he has designed for making rapid approximately comparative tests—say, over an area, or of different lamps under similar circumstances.

Physical or Chemical Methods.—Photo-Electric Cells.

There seems to be a fair balance of opinion that photometers of the physical type will be developed to such an extent as to do away with the inaccuracy introduced by the human eye in ordinary photometric work. Those who have gone farthest in the matter of investigation and experiment are those who are the most confident of ultimate success in this direction. For instance, Professor Fery says: "I am convinced that the photometer of the future will be of a type independent of the personal peculiarities of the observer; for the invariable tendency in physical matters is to devise methods of measurement which are independent of physiological processes." The workers in this direction are several; and Dr. Ives is one of the foremost, and one of the most confident of attaining practical success. As Mr. Walsh stated, physical photometry was originally developed in Germany; but during recent times great strides have been made in the United States. Roughly, physical photometers are divided into two main divisions—those which employ photo-electric phenomena, and those depending upon the measurement of radiation. It is Mr. Walsh's view that comparison of two sources of light is all that is in any way practicable at present; and though it would be a distinct advance to be able to supplant the human eye by some physical apparatus, yet, he thinks, it would be a still greater boon if some means could be found of actually measuring illumination without the necessity of constant reference to some standard of comparison. In his opinion, advance along these lines appears to be very promising in the case of those physical photometers in which the radiation of a source is measured by some instrument working generally on the principle of the thermopile. In his communication, Dr. Ives mentioned that a most serious objection to the use of the photo-electric cell is the lack of direct or uniform proportionality between the illumination and the current; but in his laboratory the conditions under which this important relationship is strictly rectilinear have been established. A new design of photo-electric cell has been worked out, in which the current does not vary in unexpected ways from the illumination; and with this improvement, Dr. Ives says, the photo-electric cell is a wonderfully sensitive instrument for use where questions arise as to colour differences. However, there still remains the disadvantage that apparently no two photo-electric cells have the same wave-length sensibility curve. Should it be possible to make cells of uniform wave-length sensibility, so that luminosity curve sensibility could be produced by a proper absorbing medium, the photo-electric cell would probably be the most sensitive and convenient of all forms of physical photometers. With experience with selenium, Mr. Harrison finds that the greatest care has to be exercised in the preparation and maintenance of a selenium cell. There is, moreover, a time-lag which is often a serious disadvantage. Professor Marchant (who, by the way, is inclined to think that an instrument depending for a reading on extinction of vision has very small prospect of accuracy) referred to an instrument designed by Mr. Turner, the Electrical Engineer at Hoylake, which depended for its working on a selenium cell. Its object was to switch on a street-lamp when the illumination fell below a certain limit determined by the resistence of the selenium cell. Such a piece of apparatus he thinks has great possibilities. Professor Addenbrooke spoke of the impurities of selenium, and he does not see much chance of using selenium cells as a standard, unless comparison can be made with some other cells, and unless, too, they are used in a short time. It is also Mr. Cooper's view that selenium is not a very satisfactory substance with which to deal. It has, he says, been proved that, if selenium is taken and purified as far as possible, the result is better than if there were not any impurities at all. Mr. Gaster recollects that when in Berlin, with Professor Ruhmer (who was connected with the manufacture of selenium), he told him that he did make the pure material.

Measurement of the Radiation of a Light Source.

In his reference to physical photometers working on the principle of the measurement of the radiation of a source, Mr. Walsh alluded to the instrument developed by Dr. Ives and Mr. E. F. Kingsbury. They use a thermopile consisting of eighteen junctions of bismuth and silver deflecting a galvanometer of the d'Arsonval type. It is, of course, necessary to ensure that the sensitivity of the thermopile at various wave lengths shall exactly correspond with that of the average eye; and for this purpose a colour filter is used, consisting of a solution of certain chemical salts in water. It is found that with this apparatus candle powers as low as eight can be measured to an accuracy of at least 1 per cent. The chief trouble appears to be the drift of the thermopile galvanometer system, which may amount to as much as several per cent. during the time taken for the deflection and the return to zero. Mr. Walsh referred to this as a fascinating method of photometry—"a method which, I think, it will be generally agreed, is rapidly passing through the experimental stage, and which in a short time will force its way into photometric laboratories all over the world." Confirmation of this opinion is gathered from the tenour of Dr. Ives' communication. He states that the thermopile physical photometer is working admirably in practice. Its only drawback is that its sensibility is so low that it can only be looked upon as a laboratory instrument. Since, however, it is now being rather generally agreed that all photometric work involving colour differences should be done in a standardizing laboratory, this objection is not at all a serious one. In connection with this question of sensibility, it is interesting to learn that Dr. Ives is at present very much interested in the possibility of increasing the effective sensibility of all kinds of radiation measuring instruments, by some sort of current amplification, along the lines of those which have recently been developed for wireless telegraphy and telephony. The possibility is an attractive one, and is receiving attention. Photometrical methods that are subject to physiological impressions do not appeal to Professor Fery, owing to the measurements depending on the visual peculiarities of observers. In his view, apparatus for measuring the total energy radiated by an incandescent body also appears to be the method most worthy of consideration. The response of a bolometer depends on the temperature of the incandescent source. The method has a tendency to favour sources of low temperature—just the opposite to the tendency of the photographic methods. Nevertheless, in Professor Fery's opinion, it is possible to get over this difficulty by the use of suitable screens. In 1908, he employed with success a radio-micrometer, combined with a screen composed of a solution of copper acetate, in order to provide a direct reading photometer giving the same sensitiveness throughout the spectrum as the normal eye. More recently he has used cells of suitable absorbing mixtures with a thermopile. Mr. Trotter is inclined to think that a differential bolometer depending on the resistance of a fine wire is the best method of relying on direct physical measurements; but it entails the use of expensive apparatus. While the employment of thermopiles or other instruments for measuring heat strikes Mr. Harrison as being novel, he cannot imagine that a true illumination value could be measured by this means. Opposed to this is all the other testimony previously quoted.

Miscellaneous Points.

Among incidental matters Mr. Frezise described screens which he has developed—a good one being of clear glass with a thin surface of opal, by which he gets equality of illumination right up to the edge of the screen. Attention was drawn by Mr. Walsh to a neutral form of filter for photometrical use which he has designed. It consists of a piece of clear glass, coated with an opaque dead-black varnish. Thin lines are then scratched through the varnish, thus baring the glass, and presenting a transmitting area which might bear any desired ratio to the opaque non-transmitting area. If these lines are carefully ruled, the transmitting coefficient will be even all over. A rough specimen which Mr. Walsh constructed gives a surprisingly even field when used on the front of a Lummer-Brodhun photometer head. A similar device which has proved very useful just lately in the reduction of very green illuminations is the use of successive thicknesses of black veiling.

Accuracy of Illumination Readings.

Towards the end of the discussion, the Chairman (Mr. Goodenough) remarked upon the necessity of having some reliable form or forms of portable photometers, if low illumination readings are to be introduced as determining factors regarding the performance or non-performance of street illumination contracts, and the compliance or non-compliance with statutory requirements in factories and workshops. He does not feel sufficiently sure that the portable photometers on the market can be relied upon with such a degree of certainty within a small or reasonable margin of error as would provide the basis for a penalty clause. At any rate, he does not feel it himself; and he does not think many of those who are acquainted with the subject of illumination feel any certainty either. What is wanted is some assurance that results are being obtained by means of some portable or easily handled instrument with approximate closeness to laboratory tests. He expressed pleasure at learning from Mr. Walsh that the National Physical Laboratory had, before the outbreak of war, began research in the direction of photometers depending upon physical and chemical methods. Obviously, the ideal is a physical and not a physiological determination of illumination, so that there can be no question of dispute as to the introduction of human error. Mr. Gaster thought the point an interesting one as to the degree of accuracy one is entitled to secure from illumination photometers. It is, in his opinion, absurd to expect portable apparatus to get nearer than 20 per cent. to absolute accuracy; to get within 25 per cent. should give satisfaction. A photometer for scientific investigation in repect of penalties ought, of course, to be a most accurate apparatus; but for factories an accuracy within 25 per cent. would be quite good enough.

Nitrate Production in Germany.—Information concerning the manufacture of nitrogenous fertilizers, the productive capacity of the Imperial works which have been established, and the organization formed for the distribution of the products, has been given by Dr. Helferich, Secretary of State to the Imperial Treasury, at a meeting in the Prussian Lower Chamber. The Secretary added that in the fixing of the sale prices, the Imperial works would have to take into consideration the question of the conditions of remunerativeness of private industry. On the other hand, a German newspaper claims that the works already in operation are producing at the rate of 300,000 tons of nitrate per annum in the form of sulphate of ammonia; so that not only are the requirements of agriculture fully covered, but sufficient quantities also remain available for the manufacture of explosives.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Forty-Sixth Annual Meeting.

The Forty-Sixth Annual Meeting of the Institution was held at the Grand Hotel, Manchester, last Saturday —the retiring President, Mr. J. G. Newbigging, M.Inst.C.E., the Chief Engineer to the Manchester Corporation Gas Department, being well supported by the presence of Mr. Edward A. Harman, of Huddersfield, the President-Elect, Mr. W. Whatmough, of Heywood, and Mr. J. P. Leather, of Burnley, Vice-Presidents, Mr. Samuel Glover, M.Inst.C.E., of St. Helens, Mr. G. S. Frith, of Runcorn, the Hon. Secretary, and other officials.

The President, in opening the proceedings, said that, as there was a heavy *agenda* to get through, it was proposed to take the minutes of the last meeting, on Oct. 30, as read.

This course was agreed to.

Letters of Regret.

The Hon. Secretary announced that a number of letters and telegrams had been received expressing regret for non-attendance, including Mr. John Bond, of Southport, the immediate Past-President of the Institution of Gas Engineers, Mr. A. Morton Fyffe, M.Inst.C.E., of Blackburn, Mr. Alderman W. Kay, J.P., the Chairman of the Manchester Corporation Gas Department, and others.

Messages of Condolence.

The Hon. Secretary, referring to the messages of condolence ordered at the last meeting to be sent to the families of Mr. Thomas Bower, of West Hartlepool, and Professor Vivian B. Lewes, said he had received acknowledgments from Mrs. and Miss Bower and from Mrs. Vivian B. Lewes. He also reported that at a meeting of the Committee of the Manchester Institution about a fortnight ago a vote of condolence was forwarded to Mr. Thomas Glover, of Norwich, on the loss of his son, who was recently killed in action. He had received a letter from Mr. Glover acknowledging his thanks and deep sense of appreciation of the brotherly action of the members in sending the message during this period of trial. "Let us all try to be worthy of our heroes" was the concluding sentence of Mr. Glover's letter.

Introduction of New Members.

The President introduced the following new members to the meeting: Messrs. Samuel Carter, of Garston, D. H. Davies, of Nantwich, Edward Hargreaves, of St. Annes-on-the-Sea, G. W. Houston, of Crewe, and Herbert Wrigley, of Oldham.

Election of Honorary Members.

The President said that perhaps members would have noticed a new feature in the "Manual" for 1916. Under the powers given to the Committee by Rule 1 they had commenced the election of honorary members; and the first two to be elected were Mr. William Duff, of Morecambe, and Mr. Charles Eastwood, formerly of Batley but now of Southport, who was originally elected a member of the Institution in 1879, and was President in 1883.

The Annual Report.

The President said he had much pleasure in moving the adoption of the annual report of the Committee for the twelve months ended Jan. 31 last, which (in addition to recording the proceedings during the past year) contained the following remarks:

> The Committee have much pleasure in reporting that the Institution continues in a most prosperous condition. The membership roll remains the same as last year—200. There have been three resignations; five names have been removed under rule 15; and the Committee record with feelings of deep regret the death of their highly-esteemed colleague, Mr. Edward Allen, M.Inst.C.E. (of Liverpool), whose irreparable loss will be keenly felt, not only by the members of this District Institution, but by the members of the gas profession generally throughout the country. They also regret to record the death of Mr. T. Bower, M.Inst.C.E. (of West Hartlepool), an old and respected member of this District Institution, who was elected in 1878, and Mr. T. Oswald (of Bolsover).
>
> The Manchester and District Junior Gas Association having decided to discontinue the Manchester University lectures during the period of the war, the usual grant of £15 has not been made. The development of the classes for gas-fitters has been seriously retarded owing to a very large percentage of men having joined the Army. The Committee have considered and recommended 31 applications for certificates to be granted by the Institution of Gas Engineers to gas-fitters over 35 years of age. The question of placing gas-works under the operations of the Munitions Act has been considered by the Committee; and a resolution was forwarded to the Institution of Gas Engineers on the subject.
>
> The annual reports of the Lancashire and the Yorkshire Commercial Sections have again been distributed to the members. The splendid work performed by these District Sections during the past twelve months—undoubtedly the most trying period ever experienced in the annals of the gas industry—cannot be over-estimated. Mr. W. Whatmough (of Heywood) was again unanimously elected the representative of this District Institution on the Council of the Institution of Gas Engineers. Mr. S. E. Halliwell (of Littleborough) and Mr. F. H. Pickles (of Kildwick) were re-appointed the representatives on the Council of the Lancashire and Yorkshire Junior Associations respectively. The finances of the Institution are in a very satisfactory condition, the credit balance being £31 8s. 11d.
>
> (Signed) J. G. Newbigging, *President.*
> G. S. Frith, *Hon. Secretary.*

Mr. E. H. Hudson (Normanton) seconded the adoption of the report, and the members agreed to it.

Statement of Accounts.

On the motion of the Hon. Auditor, Mr. Charles Potts (Hyde), seconded by Mr. William Hill (Stalybridge), the statement of accounts for the year ended Jan. 31, 1916, was approved, showing a balance in the hands of Mr. James Braddock (Radcliffe), the Hon. Treasurer, of £31 8s. 11d., as compared with £24 15s. 7d. twelve months ago.

Subscriptions of Soldier-Members.

The President said the Committee had decided to waive the subscriptions of members serving with the Forces. He was sure this course would meet with the approbation of members generally. ["Hear, hear."]

Reports of Commercial Sections.

The President said he thought these reports should be taken as read. They were very valuable documents, and the two sections were to be congratulated on the good work they were doing. They were, he was sure, serving a very useful purpose, and particularly at the present time.

Mr. S. Meunier (Stockport), the Chairman of the Lancashire Commercial Section, rising at the invitation of the President, said he had much pleasure in moving the adoption of the reports. He did not think he need waste any time in enlarging on the work of the Commercial Sections, as the report, so ably drawn up by their friend Mr. S. E. Halliwell, of Littleborough, spoke for itself. There was no doubt about it that they were doing extremely useful work, and time had shown the great necessity for these Commercial Sections. Questions they were now dealing with—brought about by the war and by Government action—such as short supplies of coal, decrease in number of licences for the export of sulphate of ammonia, creosote, oils, &c., had shown that they were up-against some very stiff propositions, and it behoved all of them, not only in Lancashire and Yorkshire, but in all parts of the country (and he hoped also the British Commercial Gas Association), to put their shoulders to the wheel and see whether they could not manage to improve their positions.

Mr. F. H. Pickles (Kildwick) said that it afforded him much pleasure to second the adoption of the reports, and to pay tribute to the work of the Commercial Sections, particularly at the present time. He did not think there was ever a time when there was more need for the work now being done to be done. The monthly meetings of the sections were very valuable to all of them—indeed, he sometimes felt that they could do with meeting oftener than once a month. They could never go back to the old way of waiting for the ordinary meetings of the members of the Institution in order to discuss these important matters—to do so would, he was convinced, be a mistake. It was a great advantage to be able to meet once a month, and to discuss matters as they arose.

The reports were then adopted without further comment.

Recommendations of the Committee.

Mr. J. C. Belton (Chester) proposed, and Mr. F. H. Pickles (Kildwick) seconded, the appointment of Mr. W. Whatmough (Heywood) as Representative of the Manchester District Institution on the Council of the Institution of Gas Engineers for the year 1916-17.

Mr. S. Meunier moved, and Mr. Tim. Duxbury (Oldham) seconded, that the sum of Ten Guineas be granted to the Benevolent Fund of the Institution of Gas Engineers.

A Tribute to the "B.C.G.A."

Mr. S. Tagg (Preston) proposed, and Mr. Robert Watson (Doncaster) seconded, a further recommendation of the Committee that £5 5s. be granted to the British Commercial Gas Association.

Mr. Watson desired, at the same time, as a member of the Executive Committee of the British Commercial Gas Association, to acknowledge with thanks the very graceful references in both the Lancashire and Yorkshire Commercial Section reports of the work done by the Association. He assured them that the "B.C.G.A." much appreciated what the Manchester Institution did for them, and the kind acknowledgments he had alluded to would spur them on to even better efforts. He really did hope that this tribute to their work would prove an incentive to those undertakings that were not as yet members of the Association, and that they would come forward and help them in view of the good work being done.

British Red Cross Society.

Mr. Kendrick said he had great pleasure in moving that the sum of Ten Guineas be granted to the British Red Cross Society. This was in lieu of the ten guineas devoted last year to the Prince of Wales Relief Fund.

Mr. C. Potts seconded; and the vote was agreed to unanimously.

Induction of the New President.

The President said the time had now come for him to perform the final duty of his office, and that was to induct Mr. Harman in the presidential chair for the ensuing twelve months. He was sure it gave great satisfaction to the Committee, as he was sure it had to all the members, to see Mr. Harman in this position. He richly deserved the honour conferred upon him. Mr. Harman during his membership had contributed various papers and had taken an active part in the debates, and in this way had contributed in no small measure to the progress and success of the Manchester Institution. He was confident they all wished him a very pleasant year of office. He could only say that they would all do their best to make it a conspicuous success.

A Loyal Key-Note in the "New Year."

Mr. Harman then took the chair amid the cordial plaudits of his colleagues, and asked that he might, first of all, be permitted to say that as they were met together upon matters concerning the public interest, and also of interest to the Nation as a whole, and as the Nation was passing through the most critical period in its history, he proposed to ask the members to rise and join in singing the National Anthem—to show their patriotism at the commencement of the "New Year" of the Manchester District Institution.

The members having joined heartily in the singing,

The President said the first business he had to undertake was to propose a hearty vote of thanks to their retiring President, Mr. Newbigging, for his splendid services during the year. He (the President) was unaware when he entered the room that this would be his privilege, for he certainly esteemed it as such. The members all knew how deeply the Institution was indebted to him for his splendid work of the last twelve months—he believed the resolution applied to the last twelve months only, although Mr. Newbigging had held the presidency two years—and his services had been invaluable. He had rendered every kind of assistance it was possible for a President to render, not only in his valuable addresses and in persuading his Committee to allow them to view his magnificent works, which, as they knew, were masterpieces of engineering skill, but he had been in personal touch with everything appertaining to the interests of the Institution. He was sure he voiced the feelings of the members in proposing a hearty vote of thanks to him for his services.

Mr. W. Whatmough said he had much pleasure in seconding the vote of thanks. Mr. Newbigging throughout his year of office had shown great business aptitude and knowledge of the requirements of the industry. They had had a very happy year indeed, especially in the Committee meetings.

Mr. Newbigging's Thanks.

Mr. Newbigging said he thanked the proposer and seconder for the kind words they had used in proposing the vote of thanks to him for the small services he had been able to render during the two years he had held office as President. He had been fortunate in being ably supported by his Chairman, Alderman Kay, J.P. (whom he regretted could not be with them that afternoon owing to a previous engagement), and his Committee. He particularly wished to thank the Officers and the Committee of the Institution for the kind help and consideration they had always given to him, and, as Mr. Whatmough had said, they had had a very happy time together. He particularly desired to mention the services of Mr. Frith, their esteemed Hon. Secretary. Mr. Frith had done all the drudgery, and he had simply had to look on. The Hon. Secretary had done excellent work; and he was much indebted to him for relieving him in many respects. He was sure he would look with very great pleasure on the two years of his presidency, and again begged to thank them for their kindness.

The Presidential Address.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—Let me first of all tender my sincere thanks for the honour you have conferred upon me by electing me President of the Institution. No one recognizes more fully than I do my limitations, as a Consulting Engineer only, for the duties involved; and therefore at the outset I would claim the indulgence that you are, I am confident, prepared most generously to concede, and upon which I rely.

THE WAR—AND AFTER.

It will be appropriate to remark upon the difficult times in which we are living; and indeed it would be impossible not to do so. Gas engineers, in common with everybody else, have never before had such a severe time of stress and strain. Well has it been said that civilization appears to be bankrupt. The world has been astounded by the enormous proportions of the present war. More than one-half of humanity is engaged in it. Millions of men are in arms against each other. So long as the motto, "Might is Right," is adopted by individuals, there can be no cure. Only let it be reversed, then all will be well. Apart from the external warfare—distracting as that is—there have been (interdependent upon the war) difficult problems to solve inside the works, which are so well understood by all that it is not necessary to dwell upon them.

There are not wanting people to tell us what will happen when the war is over—a consummation devoutly to be wished. But their prophecies may be discarded. One thing is certain. Gas-works will still be required; and it is the difficult times through which we are now passing which should qualify for the exceptional opportunities of the future. It is equally certain that when the war is over, labour difficulties will have to be met and overcome. To provide for this, hand labour must be replaced by machinery, whenever and wherever practicable—not merely, if at all, for the sake of financial economy, as for the economy of physical force. One is bound to recognize that this is being prodigally wasted all over Europe and elsewhere; and therefore in time to come the man who will be able to pull a lever or turn a valve-wheel will become increasingly valuable. In many ways, organization may be improved, which will have desirable results in the general working of all undertakings.

ENGINEERING AND TRADE.

With reference to gas engineering as a whole, much might and ought possibly to be said; but it is not my intention to attempt the impossible and to range over the entire ground covered by the term. Included in it may be, directly and indirectly, said to be the whole of civil and general engineering, together with architecture, chemistry, and many other subjects. The definition of the Institution of Civil Engineers to my mind exactly indicates also the province of gas engineering. It is as follows: "A Society established for the general advancement of mechanical science, and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a civil engineer, being the art of directing the great sources of power in Nature for the use and convenience of man." Adopting this definition, then, gas engineers should be in the front rank of professional men. Their work includes numerous branches of science and (if I dare say so) commerce, too. They are inseparable; and yet there are those who, for their own reasons, desire to keep science and commerce as far asunder as the poles.

The vexed subject of trade is one which should not be lightly ignored. While it is easy for eminent engineers to scorn such a word, it is nevertheless a fact that many, if not all, are directly and indirectly intimately associated with it. There have been those who have rigorously deprecated any connection with trade. This attitude has only been superficial; for, as already indicated, there has been a strong affinity existing, unseen by the public eye. A wiser generation will realize their complete association.

EVOLUTION OF GAS ENGINEERING.

Gas engineering has been a matter of evolution. Take, for instance, the early gasholders. Look at the rectangular ones recorded by Accum and others in the year 1815. A noteworthy gasholder is mentioned at the Brick Lane station of the Chartered Gas Company as having a capacity of 22,000 cubic feet; while another belonging to the same Company was equal to 15,928 cubic feet, and at Westminster the "gasometer" was equal in capacity to 14,808 cubic feet. The illustrations in Accum's book have considerable interest in them. Compare these with to-day's colossal structures, capable of storing millions of cubic feet, and the development will at once be apparent. In the year 1815 Accum states: "I am informed by Mr. Clegg, the Engineer of the Chartered Gas Company, that the total length of pipes laid down as mains, in the streets of London amounts already to nearly fifteen miles." In the last published returns available for the three London Companies, the length of mains is recorded as being more than 4000 miles; while an additional 2000 miles is accredited to eight London Suburban Companies.

The early designers are to be admired for their pioneer work. The man who made the first wheel little dreamt of the subsequent uses to which the principle would be applied; or even the man who designed the first wheel-barrow. These men discovered certain broad principles which are yet only in their infancy. The developments of the past hundred years have been amazing; but who shall predict what the next century has in store for gas undertakings?

Primarily for gas engineers are the questions as to the most desirable form of carbonization of coal, the design of regenerative furnaces and apparatus therefor, all kinds of purification plant, and the intricate and complicated questions of the best machinery available and suitable for the transport of all kinds of material. The working and making the best out of the residuals are of immense importance—one should say of national importance. It will be remarked that these are largely questions which each engineer must deal with according to special local and other considerations.

It is not unusual to hear the statement that a small gas-works is the unit for a large one. This is certainly not the case. Dealing with a few tons of material per day is not like dealing with thousands. Neither is the business of controlling and directing a few men comparable with that of hundreds. Take the task of supervision alone. In many a small works, a glance round them is often all that is required to ascertain that everything is in order, or otherwise; whereas in a works covering many acres, several hours are necessary.

EXTENSION OF WORKS.

In all works alike, the proportions of the plant have to be considered and recorded; and, where a deficiency is apparent, the plant must be increased as opportunity arises. A plant-book, showing the sizes and capacity of all apparatus, is an indispensable item in all well-managed works. In planning a new works, it is now the practice to arrange for complete sections, so as to add additional units as required. But when increasing an antiquated works, the conditions are totally different. The ground site, which may be ample in area, may not have the shape or possibilities available for this idea. Take as an illustration where a new retort-house may have to be erected in an isolated position, and the connections to the existing plant have to be carefully rearranged. It is an easy matter to insist that the whole of the works wants pulling up by the roots, so that an economical and efficient plant may be installed; and incidentally calling in question the ability of the designer—thereby creating considerable local inquiry as to "why all this was not done before?" This method does not require the maximum ability. One readily understands, by a large expenditure of money—especially if borrowed upon easy terms repayable over a long term of years—an immense economy in manufacture could often be effected. One knows of old loans, extending for fifty, sixty, eighty, and even a hundred years, where the sinking-fund is consequently trifling. It is interesting to refer to the blue-books, with regard to the present practice of the Local Government Board. In the year 1903 the periods for the repayment of loans sanctioned by them, relating to gas undertakings, were fixed, and the following particulars, relative to gas-works, are recorded:—

THIRTY YEARS: Gasholders, tanks, hydraulic mains, condensers, scrubbers, mains, governors, coke-stage, and tar-well.
TWENTY YEARS: Purifiers (boxes and covers), exhausters, station meters, and washers.
FIFTEEN YEARS: Sulphate plant, benches, photometer, and testing appliances.
TEN YEARS.—Stoking machinery, meters, cooking-stoves (for hire), lamp and columns, and working capital.
FIVE YEARS.—Incandescent gas burners and fittings.
TWO YEARS.—Retorts.

In the same paper an example is given of an equated period for the repayment of a loan for gas-works purposes. It is as follows:

Description of Work.	Estimated Cost.		Usual Term of Years Allowed for Repayment.		
Buildings	£2500	×	30	..	£75,000
Mains	1245	×	30	..	37,350
Gasholders . . .	1500	×	30	..	45,000
Condensers . . .	530	×	30	..	15,900
Purifiers	1000	×	20	..	20,000
Benches	1200	×	15	..	18,000
Meters	530	×	10	..	5,300
Retorts.	600	×	2	..	1,200
	£9105				£217,750

Then $\frac{217{,}750}{9105} = 23{\cdot}9$ years, the period for the repayment of the total loan; and 24 years would be allowed.

It will be noticed that the old long-term loans have died out, and rightly so.

It is the rearrangement of the existing conditions which brings out the best ability in the engineer. Here, too, permit me to say that the best advice to be obtained upon any reconstruction scheme is from the engineer upon the ground, and to whom full support and consideration should be granted. Too often new works are undertaken and erected, when the advice of the resident engineer is discounted by the authorities. Later, possibly when the work is completed, they sometimes allow the very one who ought to work the plant to the best advantage to take another appointment rather than increase his remuneration commensurately with his increased responsibilities. It is a simple aphorism that the truest economy is a well-paid servant. This elementary principle even to-day requires to be emphasized, especially so where chief officials are concerned, whose remuneration is not determined by any Society or Union. On the contrary, too often the cheapest salaried official is sought, even where the workmen's wages of the district are the highest. Little consideration is given to the position the engineer has to maintain in the district where he resides.

SELECTION OF PLANT.

Is sufficient consideration given to the subject of selection? One sees plant installed which has not been thoroughly examined. As a general rule, engineers should cultivate the power for selection rather than of designing. The power of being able to determine from many designs which is the best, is one well-nigh amounting to a faculty. It is not the new thing which is always the best. On the other hand, it does not do to be captious and cynical concerning a new idea. Experience and careful thought can accomplish wonders. True it is that some (but only a few) can decide—almost by intuition it would seem—which is the best of many designs. But the majority have not the power. The ordinary plodder has to accomplish the end by steadier, and sometimes by more reliable, means. New ideas are not so much wanted at the moment as the development of old ones. A contribution to, or improvement of, an old design may be as important as a complete new one, while it is quite possible that a valuable invention will be discovered therefrom.

PLEA FOR BEAUTY IN DESIGN.

In a utilitarian age, may one be permitted to enter a plea for this? Why should architectural and engineering structures be hideous, when a few extra pounds would be well spent in decoration? There are to be found gas-works magnificently designed; but can it be truthfully asserted that the majority are? I should like to refer the members to John Ruskin upon such a subject.

STATUS OF THE GAS ENGINEER.

I am fully convinced that this is a most important matter. For inexplicable reasons, it has been allowed to pass unnoticed. A glance at any local directory will confirm this. In even large cities and towns, a few gas-fitters, plumbers, and gas-appliance makers may be found under the classification of gas engineers, while the chief responsible officials of the gas undertaking are absent. I do not want to make invidious comparisons beyond saying that gas engineers are worse represented in local directories than any other profession, trade, or calling. The gas engineer is brought into touch, generally speaking, with every householder resident in the area of supply of the undertaking, and is probably as well known by the inhabitants as any public official. Of course, the directory notice is not of itself consequential; but it is an indication. Professionally, the gas engineer is largely isolated; and it is the particular function of such institutions as the district ones, to foster a bond of friendship and union. At the same time, the *esprit de corps* can be considerably strengthened by a cordial appreciation of each other's work and responsibilities. One engineer is especially good at one thing, another equally expert at another.

The comparison of manufacturing returns is perhaps largely responsible for a spirit of undue rivalry. These returns are of little value, and are often entirely misleading—apart from local and other considerations. For instance, it is outside all fairness to compare local authorities with companies' undertakings. The former are practically free from outside control and testing restrictions, whereas the latter are vigilantly and often unscrupulously molested. On the other hand, the engineer of a company invariably enjoys greater freedom of action than one employed by a local authority. The make or sale of gas per ton of coal is often quoted, with little knowledge of the coal purchased; and this is frequently outside the control of the engineer. A poor local coal may be advantageously used, but showing an insignificant make of gas per ton. Yet the sale of gas per ton is often flaunted as though it were the only item to be considered. The scattered area of supply is a fruitful source of "unaccounted-for" gas. Unaccounted-for it is true, but not necessarily due to leakage. Some works correct to 60° Fahr., 50° Fahr., and lower; while others are content to take the gas at the temperature of the station-meter. Consider the reduction in volume of gas measured (say) at 70° Fahr. at the meter, and on a winter's day, when the consumption is at its maximum, at a distance of three to six miles from the works, when transmitted through cold mains and service pipes over open passages into a cellar having a temperature below freezing point. Such returns are often quoted to the detriment of one undertaking, and the superiority of another. The sooner these comparative statements are only used or quoted with reasonable and equitable explanations, the better for the status of the gas engineer and the right feeling for each other which should pervade all the members.

NATIONAL GAS INSTITUTE.

Following upon the status of the engineer is the ever-recurring question of the provision of a central home in London, capable of the promotion of useful work as well as affording evidence of the importance of the gas engineering profession and its allied industries. For the Institution of Gas Engineers in London a couple of hired rooms is to-day considered sufficient for all purposes. Should a Sub-Committee be called, a curtain may be drawn across a portion of the room to provide for its requirements. Is such an arrangement worthy of the wealthy gas undertakings of the United Kingdom? Without for a moment reflecting upon the excellent work done by the able Secretary (Mr. Walter Dunn) and his assistants, it is manifestly impossible, under such paltry conditions, to efficiently negotiate the work which should be undertaken. It has been frequently urged, and not too strongly, that nearly every other profession and trade has its central organization, properly housed and equipped. Not until a national gas institute, worthy of the name, is provided, will the disgrace and discredit to gas undertakings as a whole be abolished. That the establishment of such an Institute remains in a state of suspended animation owing to the war, is appreciated by us all; but there are not wanting seers who believe that some day it will be an accomplished fact. Foremost among these is the immediate Past-President of the Institution of Gas Engineers (Mr. John Bond) who by his generosity has given the project a fresh impetus.

TOLUOL.

The subject of the moment is the production of toluol for war purposes; and there are various suggestions for increasing the yield of this. For instance, there is Rollason's method of mixing, the coal with a small percentage of unburnt limestone. This process appears to be based on the idea of generating a gas in the retort at the same time the coal gas is being made, in order to sweep out the gas rich in hydrocarbon vapours, which would be evolved at the beginning of the charging time—probably during the first hour or so after the charge has been put into the retort. There seems to be some doubt as to the advantages obtainable from the method. My own opinion is that it is not all that is desired. What is required is a gas already formed that can be turned on at the lid of a through retort as soon as it is closed, so as to sweep out the hydrocarbon vapours as soon as they are produced and at their maximum. There is nothing new in this idea—indeed, it was mentioned at one of the London meetings some seventeen years since by the late lamented Professor Vivian B. Lewes, who also suggested blue water gas for a similar purpose.

In removing the toluol, all, or nearly all, the condensable hydrocarbons—*i.e.*, benzene, xylene, toluol, &c.—are removed by the washing oil or tar; so that if a measure of the condensable hydrocarbons or hydrocarbon vapours can be made at the inlet and at the outlet of the washer, the amount of work done by the washing can be obtained, and a fair estimate of the quantity of toluol removed can be found, especially if the amount at the inlet of the apparatus has been determined by the washing test.

There is at least one way in which this can be done—that is, by making a determination of the condensable hydrocarbons or hydrocarbon vapours at the inlet and outlet by means of alcohol in the Hempel apparatus.

The Germans have shown us how necessary organization is, and they have also shown how very much we were behind in allowing the products from gas-works to be exported and treated in their country—only sending back the manufactured article for sale. Consequently, we were becoming shopmen and shopkeepers. How much, or rather how little, toluol was there in this country when the war broke out?

OBSERVATION.

With all the theoretical and practical training available, there is one thing which requires emphasizing upon the younger generation—viz., the cultivation of the power of observation. One of the greatest engineers has remarked, "After all has been said, it is only by observing that we know." Knowledge comes along that line. Among so-called uneducated people, this power is possessed in a larger degree than is often realized. The workman who observes is far more valuable than one who does not. He becomes more or less an inventor, and adapts certain tools and places to suit his own particular work.

Let me urge a movement by the members to afford the youth of the gas profession greater opportunities for becoming engineers, draughtsmen, chemists, tradesmen, skilled artisans, &c., by supporting such movements as lead to the fostering of all such ideas. Increased opportunities of this kind for our youth would reveal the inherent inventiveness of our race in the arts and crafts of peace.

QUALITY OF GAS.

One of the most important subjects to ponder is the quality of the gas issued from the works. Having regard to the necessities of the Munitions Department, gas undertakings are in some instances being tempted to strip the gas of its illuminating and heating constituents to an undue extent. Regard and careful attention must be paid to the requirements of the gas consumers, or the goose which lays the golden egg may be killed, and then whence will come the eggs? Consideration must be had to maintaining some reasonable amount of illuminating and heating constituents in the gas. What is the use of light, so called, which will not illuminate, or gaseous fuel which will only emit a pungent odour? *Verbum sap.*

COAL STORAGE.

The question of coal storage is nowadays one of supreme importance. In colliery districts, it has hitherto been considered that a maximum month's storage of coal is sufficient. I have always advocated from ten to twelve weeks' maximum storage. This is a subject which will have undergone careful reconsideration during the war; and the ultimate outcome of the experiences and possibilities remains to be ascertained and determined. The deterioration of coal is very small, while the security against emergencies and fluctuations in market price is thoroughly sound.

COKE STORAGE.

The desirability of preventing the accumulation of a stock of coke still holds good. The rapid disposal of surplus coke is always a wise one. The normal local requirements having been provided, the surplus coke should be sold at the best prices obtainable. This is a subject which may not require immediate consideration, under present conditions; but it is one which must not be forgotten.

TAR DEHYDRATION.

So recently did Mr. E. V. Chambers, of Huddersfield, present a valuable paper to this Institution upon this subject, that it is probably too soon to dwell upon it again. The general principles in my opinion hold good, although the prices suggested have passed out of existence, through the ever-varying market conditions. Later, we may hope for a further contribution from such an authority.

The really magnificent work accomplished by the distinguished Engineer and Manager of the Road Board (Mr. H. P. Maybury, M.Inst.C.E.) deserves more than passing recognition. The great value of his efforts will be more apparent in the future.

LIQUID PURIFICATION.

We cannot but deplore that little has been accomplished upon a practical basis, in the matter of purifiers filled with liquid, required to be drained off and refilled from overhead tanks. Solid purification still holds the field. The magnificent experiments with the Claus system carried out by Mr. Charles Hunt, M.Inst.C.E., at the Birmingham Gas-Works some years since, have not been followed up, as might have been expected. All the same, Mr. Hunt placed the gas profession under a lasting obligation in this matter, as in many others.

VERTICAL OXIDE PURIFIERS.

While various designs are extant, they have not made their practical appearance, to my knowledge. Certain it is that the economy in ground area, as in the case of vertical retorts, warrants their trial—especially having regard to the use of machinery for the filling and emptying of the material. It is well known that Messrs. Clapham Bros., of Keighley, have for some years dealt with this subject.

SULPHUR COMPOUNDS.

With reference to the question of the use of oxide of iron, it is valuable to refer to a paper by so distinguished an authority as Dr. Samuel Rideal, in June, 1903, entitled "Coal-Gas Standards," in which the following paragraph appears:

> "As lime only arrests 2 or 3 per cent. more of the total sulphur than oxide of iron, the disadvantages and costs attending its use more than outweigh any possible theoretical benefit accruing to the consumer by the removal of this small amount of extra sulphur. In London alone I calculate that more than one thousand times as much sulphur is contributed to the air by the coal consumed as by the gas supplied, and that the sulphur impurity developed from illuminating petroleum in London at the present time is practically equal to that derived from coal gas."

Before a Committee of the House of Lords in June, 1903, the late Sir George Livesey, when cross-examined by Mr. Freeman, K.C., stated as follows:

> "I have been in the gas industry for fifty years, and it has never been proved that sulphur compounds caused any injury to health. In fact, I believe a little sulphur burnt in a room is good for health."

SULPHATE OF AMMONIA.

The splendid work accomplished by the Sulphate of Ammonia Association, under their able Chairman, Mr. D. Milne Watson, demands whole-hearted support from all gas undertakings. To give the aims of the Association would take longer time than is at present available; but one may refer to the splendid brochure issued in July, 1915, entitled "The Market for Sulphate of Ammonia—and its Future," a copy of which may be obtained from the Secretary (Mr. A. Dawson).

In this connection, let it be stated that it is my belief that all gas-works, however large or small, generally speaking, should be provided with a sulphate plant available for emergencies, which are always liable to arise. Like all other plant, its value could be depreciated annually according to its prospective life.

MAIN AND SERVICE LAYING.

Arising out of the present strenuous times will be the subject of extended or restricted main-laying. In speaking of this, it is proposed to adopt the generally accepted definition that main pipes are cast-iron ones and services wrought-iron ones.

To what extent are gas undertakings justified in extending main and service pipes, is a most important question? As conditions vary so largely, it is quite impossible to lay down any hard-and-fast rule applicable to all cases. In outlying districts, it was formerly the practice to charge the full cost of the main, although laid in the public highway, to the property owner. Later, a more generous and businesslike policy prevailed; and a charge of one-tenth of the capital cost was made. At the present time any progressive undertaking would probably be willing to lay a gas-main along a public highway, free of cost, for a distance of 100 yards or more, according to the estimated consumption of the premises to be supplied. Where there are considerable extensions of property contemplated, a much larger consideration than this would even be given. In the case of wrought-iron service-pipes, some time since it was the almost invariable practice to charge for their full cost, from the main in the public highway up to the meter inlet. More recently, the service-pipe was charged from the entrance to private property; while some undertakings charge for all work executed beyond 30 feet. At the present time, many are prepared to lay the service-pipes free to the inlet of the meter, and also fix the meter and all stoves required free of charge.

One rule sometimes adopted is to estimate the cost of the main to be laid, and to insist upon the estimated revenue being such as will pay for the interest and sinking-fund charges upon the same.

In my opinion the immediate financial consideration should not be paramount, as a new consumer being acquired (even at a small loss) may mean an addition eventually of other consumers, nearer home, who would be a direct source of profit to the undertaking. Moreover, the use of gas in outlying districts is sure to have a beneficial effect upon friends of the occupiers in the town. A further important consideration is that often when a main is laid in a public highway to an outlying district, lamps are placed to the great convenience and safety of the public. These lamps may hardly be considered as profitable revenue earners, but their value is recognized from a public standpoint. This may not be operative as a consideration in the case of a company; but it is nevertheless worthy of notice to gas undertakings interested in the prosperity of the municipality.

The extension of gas-mains and other services into the outlying districts has frequently been followed by extension of property, which must have a distinct effect upon congested districts of population. The utilization of gas for lighting, heating, and motor purposes renders its presence in the smallest hamlet, or even upon farm premises, a valuable acquisition and economy.

Up to a late date the fixing of meters has been charged for; but this charge has now pretty generally been abolished. There can be little doubt as to the advantage accruing to a gas undertaking by adopting a generous policy with respect to main and service laying. The desirability of charging a rent for gas-meters is in my opinion unquestionable and should be retained.

I do not recommend the fixing of the internal gas-fittings free. In my judgment, these should be paid for by the owner or tenant, as with a change of occupier or owner complications are always likely to arise as to the ownership of the pipes and fittings.

Respecting the main-laying operations, in most towns the main is laid on one side of the street, which is an imperfect arrangement. It is much better, whenever possible, to have a main on each side of the street—thus avoiding the necessity of damaging the street when laying a new service, renewing an old one, or any other examination required. The practice of cutting a channel, or crossing the street, is objectionable, especially in towns where there are tramway lines laid upon a concrete bed.

Whenever possible, mains should be connected to form a circuit, instead of finishing at a dead-end. The circulation and equal distribution of the gas well compensates for the extra cost involved. It is also clear that in the case of a broken main, necessitating bagging, both sides have a supply available. Indeed, I am so satisfied upon the point that I would almost recommend in a cul-de-sac that the gas-mains should be tied across at the end of the street. Moreover, where gas has remained in the pipe for any length of time it deteriorates; and until it is used it is a fertile source of dissatisfaction to the consumer.

In examination for gas escapes, unless the defective place can be at once located, it is desirable to examine the service pipes first before proceeding to strip any portion of main, unless there is positive evidence that the main is broken.

Let me be permitted to remind members that one of our honoured Past-Presidents, Mr. John C. Belton, has introduced a special form of "Facile" syphon, which is the outcome of practical experience. This syphon possesses numerous advantages, and is well worth adopting. I have used it with considerable benefit, as doubtless have many others.

At the conclusion of the war, it is quite possible that a large number of unskilled workmen will be available, who could advantageously be employed in developing the distribution system.

OTHER MATTERS OF NOTE.

Reference to condensation, scrubbing, washing, high-pressure lighting, and many other matters has been omitted for want of time; but I would suggest that they might each form the subject of a separate paper by a member to the edification of all.

INCREASED CHARGES FOR GAS.

There has been, and will continue to be, a hue and cry and grumbling about gas charges being increased. These increases are only the natural outcome of the augmented prices of coal, labour, and all else required. Every household commodity has necessarily increased; and yet it is considered outrageous that gas should follow suit. The fact is the public has got used to constant reductions. In Huddersfield, during my term of office, the charges for gas were reduced all round by 9d. per 1000 cubic feet; and yet a slight increase, to provide for war emergencies, is freely criticized.

I have here a handbill calling a public meeting of protest against the arbitrary action of a gas company in the district increasing the price of gas. Surely the conveners must have heard that a war is raging.

GAS-WORKS CONTROL.

With your permission, I should like to say that the most efficient control is generally effected by a small board or committee. It is common knowledge that large meetings are always factious and unjust. Number always rapidly diminishes the responsibility of each member for his vote. The voting value of each member is the percentage of his personality. If there are a hundred members, then each member is constituted 1 per cent., and he becomes irresponsible. If there are ten members, then each member is of ten times more value than represented in the former case, and so on. Hence the value of small committees, where important work has to be transacted.

LABOUR QUESTIONS.

Does not the question of how to interest the workmen in their work arise as an important one? This problem remains unsolved. All schemes of co-partnership may be a step in the right direction, but are only a step; closer union is required. How to obtain it is the difficult matter. Annual outings and various entertainments only touch the fringe, if at all. There is something "rotten in the state of Denmark," when the aged and infirm go from a factory to the workhouse. Education has accomplished little. The reformation must come from within the man—from his own steady will and purpose. Everything external appears useless.

It may take time, generations possibly. Any sign of consideration and kindness is mistaken for weakness by the workmen and boards of control. It is wrong to assert that how a man spends his leisure time has nothing whatever to do with his work. It has a great deal to do with it. Are the younger men invited to improve their leisure time, or discouraged? Let the man himself be cared for properly by his employers.

A workman's well-being is not dependent upon the amount of remuneration but upon the conditions of employment, the treatment from his superiors in office, the amount of appreciation and encouragement bestowed, coupled with any or many other little amenities of life. These all contribute towards making work a pleasure.

Anything which interferes with the worker's comfort and cannot be proved to be essential, is an abortion, and should be abolished. On the other side, the workman has his obligations and should recognize them.

To my mind, one of the ways to increase the efficiency and happiness of the workers is to endeavour to establish a personal and sympathetic understanding between the employers and employees. This is as nearly as I can determine the root of the matter. The workman should be enabled, and even encouraged, to get into personal touch with his employer. Too often only an indefinite board or committee exists, whom the workman imagines has no soul, and consequently no more consideration for him than for his shovel.

The Ministry of Munitions has issued excellent reports upon industrial canteens and welfare supervision, which doubtless many of you have purchased.

It will be remembered that the "Health of Munition Workers Committee" was appointed with the concurrence of the Home Secretary, "to consider and advise on questions of industrial fatigue, hours of labour, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops." The investigations and recommendations of the Committee are well worth the study of every employer of labour.

HUDDERSFIELD.

It is usual for a President to make some reference to the town in which he resides. The area of the county borough of Huddersfield is 11,859 acres, and the population at the last census (1911) was 107,825. A solid foundation has been laid by a past wise generation, as instanced in the fine public services available. The gas, water, electric, tramways, markets, fairs, abattoirs, hospitals, cold storage, baths, cemeteries, and last, but not least, a fine technical college are all owned by the Local Authority. Should there be any philanthropic person, in a difficulty as to the disposal of his surplus wealth, let me suggest a few suitable channels, such as a public library, an art gallery and museum, and a few hundred almshouses where the aged and infirm may spend their last few years in peace and comparative comfort. For the past twenty years I have insisted that Huddersfield will eventually become another Manchester. With the advent of "British Dyes Limited" and other works, it is on the high road to further great development. The public services in many directions are ready for more work. The Midland Railway have brought their system into the town, but are apparently awaiting the trend of events before erecting passenger and goods stations with a hotel worthy of the Company. The town has been for many years anxiously awaiting this crowning event.

OUR INSTITUTION.

In my opinion this Institution has now grown to such a size, position, and importance as would justify the granting of a certificate of membership, which should possess some real value.

In conclusion, let me urge upon the members an increased interest in the Manchester District Institution of Gas Engineers and its objects, as well as to each other individually—certain as I am that in doing so we shall best serve the profession of which we form an integral part.

By a happy inspiration, the President concluded his address with Longfellow's well-known exhortation.

> Let us then be up and doing,
> With a heart for any fate,
> Still achieving, still pursuing,
> Learn to labour, and to wait.

Thanks to the President.

Mr. Newbigging said he rose with very great pleasure to propose a vote of thanks to Mr. Harman for his address. If the address might be taken as a criterion, he was sure a very successful year of office was assured to him. Having had to prepare an address himself, he knew something of the difficulties connected with it; and it made one wonder what the next occupant of the chair would have to say. Mr. Harman, however, seemed to have had no difficulty in this respect. His address was full of the dry humour and philosophy which were natural to him. Of course, as a consulting engineer, he had not expressed definite opinions on any subject [laughter]; but they were nevertheless very much indebted to him for it.

Mr. J. H. Brearley (Longwood), speaking as a twenty years' neighbour of Mr. Harman's, said he had listened to the address with considerable interest and pleasure. He noticed he had eulogized Huddersfield a good deal, and was of opinion that it would eventually become another Manchester. This was an interesting feature, and he thought it would be a good thing for Huddersfield if it developed on the lines portrayed in the presidential address.

The vote having been carried by acclamation,

The President briefly returned his thanks.

Naphthalene.

Mr. Henry Simmonds, F.C.S., of Bury, then read his paper on "Naphthalene," which, together with some of the remarks upon it, will be found on this and succeeding pages.

Carbonization of Pitch.

Mr. Tim Duxbury (Oldham) afterwards gave some important figures on "The Carbonization of Pitch," which, with subsequent remarks made by members, bearing upon the question, will be found on p. 482.

Thanks to the Authors.

The President said they had had very interesting papers from Mr. Simmonds and from Mr. Duxbury. They would doubtless take the earliest opportunity of thoroughly studying them, for they would certainly well repay close study.

Mr. J. P. Leather (Burnley) moved that the heartiest thanks of the members be accorded to Messrs. Duxbury and Simmonds for their valuable contributions. He confessed that, when he himself read a paper on naphthalene many years ago, he thought he had said the last word on the subject, and that he had settled the matter once and for all. [Laughter.] At the same time they had been very glad to have another paper on the subject, if only because it emphasized points which needed emphasizing. They had all been delighted with Mr. Duxbury's data. He had provided them with an exceedingly valuable contribution.

Mr. G. W. Tooley (Manchester) seconded the vote; and it was cordially agreed to.

The authors briefly returned thanks.

On the proposition of Mr. R. G. Shadbolt, seconded by Mr. William Smith, a very hearty vote of thanks was passed to the retiring President, Mr. J. G. Newbigging, the Vice-Presidents, the Hon. Treasurer, the Hon. Secretary, the Committee, and other officials of the Institution for their excellent services during the past year.

NAPHTHALENE.

By Henry Simmonds, F.C.S., of Bury.

[A Paper read before the Manchester District Institution of Gas Engineers, Saturday, Feb. 26.]

I do not propose to give you a long paper on naphthalene, but rather a short account of the means we have taken at Bury to reduce the number of complaints to a minimum. I think I can say that in the last twenty years we have had more papers written on this matter than on any other subject. Naphthalene is an old enemy, and most of us have made its acquaintance. Many gas engineers have devoted much of their time to it; and we are indebted to Messrs. Botley, of Hastings, Mr. Ferguson Bell, of Derby, and the late Mr. William Young for their investigations. The increased number of stoppages recorded last year is, I trust, sufficient reason for raising the question anew.

The advent of the regenerator furnace in the retort-house was the beginning of naphthalene troubles. The high temperatures employed to carbonize the coal to obtain large volumes of gas, and the cracking-up of what at lower temperatures would be left as tar, mean decreased quantities of oils in the gas, and more naphthalene to be dealt with in the mains and services. Again, the extraction of toluol and benzol from the gas by the "C" process has not helped matters, and no doubt was responsible for the increased number of complaints that many gas managers had to deal with during the last twelve months.

I have tried many processes for the cure of naphthalene; but I think it will be sufficient if I give the results obtained and the methods used for the last three years—1913 to 1915 inclusive. In the year 1913, "Solvene" was used in a Livesey washer at the approximate rate of 30 gallons a day in summer and 15 gallons in winter. The washer was placed at the inlet of the purifiers. There were used 7000 gallons, equal to 0·202 gallon per ton of coal carbonized; the stoppages recorded being 2162. No doubt we experienced a certain amount of relief, although it was somewhat disappointing to find at times complaints jumping up to 30 and 40 per day. Small quantities of oil highly charged with naphthalene were found in the district syphons. One objection found with "Solvene" was the injurious effect it had on the paint of the gasholders.

For the year 1914, Russian vaporizing oil was used in a vaporizer, the connections to which were so arranged that the apparatus could be worked on either the inlets or the outlets of the gasholders. It was chiefly worked on the inlet, as the volume of gas flowing in that main was practically constant. Some 5846 gallons were used, equal to 0·177 gallon per ton of coal carbonized. The stoppages recorded were 3428. The highest number of stoppages we ever had was 60 one day in November. A residue of 15 to 20 per cent. was pumped out of the works' syphons; this being used up in a Livesey washer. No trace of oil was found in the district syphons.

Not being satisfied with the results so far obtained, I decided to try atomizing the oil with compressed air. Fig. 1 shows the general arrangement of the apparatus, which was fixed in the governor-house; the atomized oil passing direct into the towns' supply. The oil storage tank, tested to 100 lbs. pressure, has a capacity of 150 gallons. The air required to work the apparatus is taken from the West's air compressor (used for stoking machinery). This is reduced to 25 lbs. by the reducing valve, as shown on fig. 1.

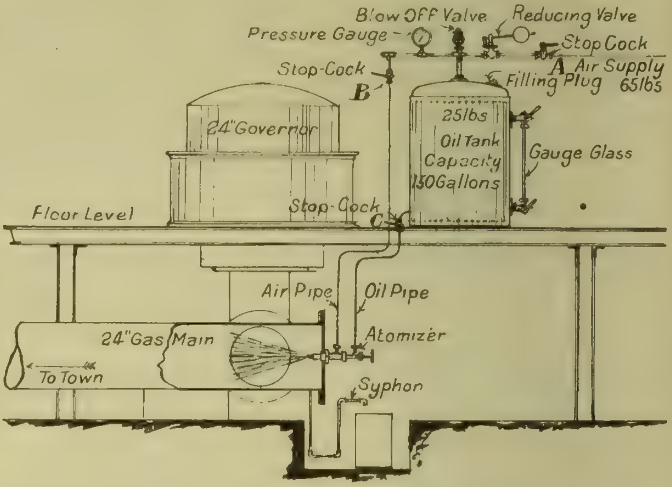


Fig. 1.—General Arrangement of the Apparatus for Atomizing Oil.

The photograph (fig. 2) shows the atomizer, which is fixed in the 24-inch main on the outlet of the governors. It is supplied with oil and air at 25 lbs. pressure by two ¼-inch pipes; the oil being regulated by means of a spindle and dial, and the air by the size of the hole in the spray nozzle. The atomizer was tested to pass one gallon of oil per hour; and to get this quantity atomized, the hole in the air-nozzle was gradually enlarged until it gave a good permanent spray without drip. Before fixing the atomizer in the gas-main, further tests were made to ascertain the amount of air required to atomize the oil. This was done by fixing up the apparatus shown in fig. 3.

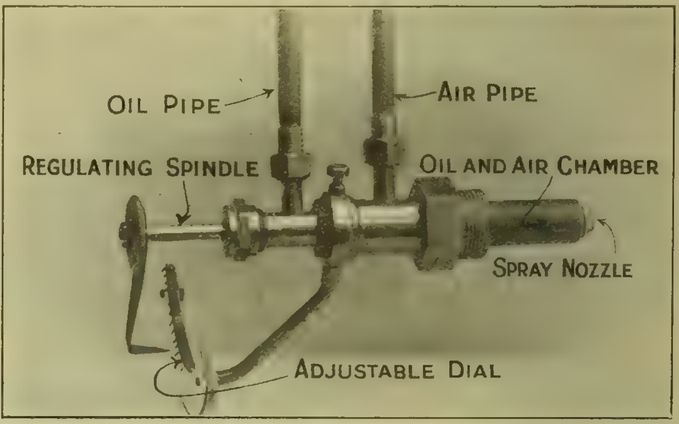
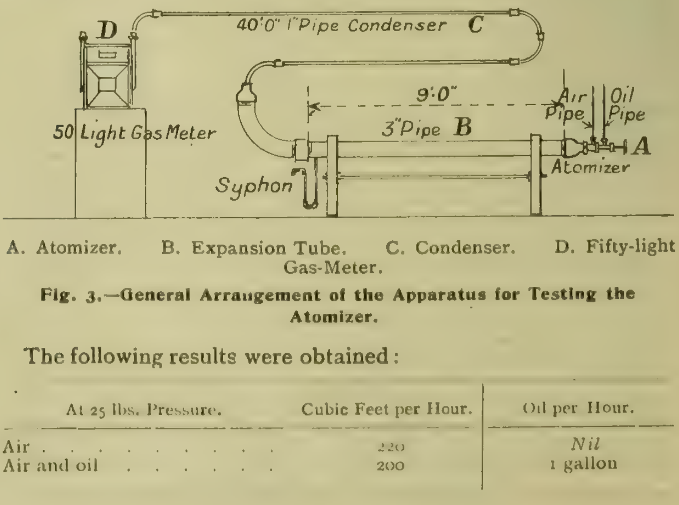


Fig. 2.—The Atomizer.



A. Atomizer. B. Expansion Tube. C. Condenser. D. Fifty-light Gas-Meter.

Fig. 3.—General Arrangement of the Apparatus for Testing the Atomizer.

The following results were obtained:

At 25 lbs. Pressure.	Cubic Feet per Hour.	Oil per Hour.
Air	220	*Nil*
Air and oil	200	1 gallon

The plant was ready by the first week in January, 1915; and as the local authorities had issued instructions restricting the lighting at night of the street-lamps, it was decided to work the apparatus from 6 a.m. to 12 p.m.—eighteen hours daily. To start the plant, the plug taps A, B, C (fig. 1) are opened; this being done by the works' foreman.

Trials were made with different kinds of oils. The light naphtha (·770 specific gravity), a distillate of shale tar supplied by the Pumpherston Oil Company, was found to give the best results; and this has been continued the whole twelve months. Two jet photometers which had been carefully standardized by the bar were fixed—one before and one after the atomizer. No appreciable difference in the illuminating power could be detected. Tests made for calorific power showed a slight increase, probably due to the heating value of the oil (138,600 B.Th.U. per gallon), more than counterbalancing the small percentage of air required to atomize the oil.

Working Costs.

Oil atomized, 5709 gallons		£230
Less aërated oil mist, 200 cubic feet by 18 hours by 365 days, at 2s. 4d. per 1000 cubic feet	£152	
577 gallons of residue at 3d.	7	
		159
Total cost		£71

Equal to 0·51d. per ton carbonized.
,, 0·042d. per 1000 cubic feet.

The results [see Appendix No. 1] are certainly a great improvement on anything accomplished before, and have given a good deal of relief to the depleted outdoor staff. During the twelve months the apparatus has been in operation the number of stoppages from naphthalene have been the lowest recorded, despite the fact that many works in the country have experienced considerably more trouble than in former years; the increase being attributed to washing the gas with tar for the extraction of toluol and benzol, which in our own case has amounted to an additional 0·204 gallon per ton of coal carbonized (see Appendix No. 2). The oil atomized for the year was 5709 gallons, equal to 0·176 gallon per ton of coal carbonized, which is 0·028 gallon less than had been extracted by the "C" process. Of the atomized oil, 10 per cent. condensed in the mains, and was recovered from the syphons. At first the oil was found in the syphons near the works, then each week it got a little further away, until it had reached the limits of our supply, some three miles off.

The result of these three years' investigations have proved conclusively to my own mind that atomized oil is far more efficacious for the prevention of naphthalene deposits than oil in any other form—it retains its oily nature, which permeates the whole system of supply, condensing out with the naphthalene deposits. The initial cost of the oil is reduced by the aëration.

The gas is manufactured in horizontal retorts charged by the De Brouwer and the West stoking machinery; the make per ton from rough Arley slack being 12,000 cubic feet, 500 B.Th.U. net. The naphthalene found in the gas varies from 3 to 5 grains per 100 cubic feet.

I would not have agreed to address you on this subject had I not felt confident that we have at Bury reduced very largely the annoyance and trouble caused through naphthalene stoppages; and I trust the information given to you will be of assistance in helping some of the members of the Institution to combat what has been the bugbear of the gas manager for many years.

DISCUSSION.

The PRESIDENT (Mr. Edward A. Harman) said he was sure they were very much obliged to Mr. Simmonds for his interesting paper. All members who had ever heard of naphthalene would doubtless want to make some remarks upon the subject.

Mr. J. G. NEWBIGGING (Manchester) said that in the first place he should like to say how pleased they all were to see the author taking an active part in the work of the Institution. He hoped that in the future he would give them the benefit of his wide experience in gas-works matters. He (the speaker) had hoped the author was going to give them the cure for naphthalene, but it seemed that he had only given them a palliative. He stated that the gas was manufactured in horizontal retorts charged by the De Brouwer and West's stoking machinery. In the case of West's machinery, he did not fill the retorts. Did he experience greater trouble from those than from the retorts charged by the De Brouwer process—the last-named being fully-charged if the workman was properly watched? Unless the conditions in the years 1913, 1914, and 1915 were identical, he was afraid the conclusions that the author had come to as to the atomizing of naphtha were not very conclusive. Naphthalene was such an elusive product that, unless the conditions were identical, it was quite impossible to say that one remedy was better than another. Of course, what they ought to do was to tackle this trouble at its root; and there was no doubt about it that it could be done in the carbonizing plant. He might give an instance. They had had vertical retorts at Droylsden now for five or six years, and they had never had one single case of naphthalene. He (the speaker) had made particular inquiries into the question only that morning, and found that they had been entirely free. He thought that rather than use these palliatives, it was much better to tackle the evil, as he had already said, at its root. Personally he was much indebted to the author for giving them an account of a means of reducing the evil; but he had hoped, knowing him as he did, that he was going to give them the absolute cure.

Mr. H. KENDRICK (Stretford) said he cordially endorsed what

APPENDIX NO. 1.

Solvene in Livesey Washer. Sp. Gr. ·924.					R.V.O. in Vaporizer. Sp. Gr. ·824.					Naphtha in Atomizer. Sp. Gr. ·770.					
1913.	Oil Used in Gallons	Oil Used per Ton of Coal Carbonized.	Residue in Syphons.	$C_{10}H_8$ Stoppages Recorded.	**1914.**	Oil Used in Gallons.	Oil Used per Ton of Coal Carbonized.	Residue in Syphons.	$C_{10}H_8$ Stoppages Recorded.	**1915.**	Oil Used in Gallons.	Oil Used per Ton of Coal Carbonized.	Residue from Street Syphons in Gallons.		$C_{10}H_8$ Stoppages Recorded.
January . . .	354	·064	A little oil recovered from district.	107	January. . .	450	·098	15 to 20 per cent. recovered from works used up in Livesey washer.	257	January . .	171	·081	45	Used up in Livesey washer	97
February . .	350	·100		66	February . .	207	·061		45	February . .	330	092	42		72
March . . .	400	·126		48	March . . .	200	·058		46	March . . .	392	·121	50		18
April	480	·156		48	April . . .	200	·072		19	April . . .	282	·108	41		8
May	552	·212		95	May . . .	300	·145		163	May . . .	404	·186	30		20
June	772	·332		279	June . . .	379	·176		515	June . . .	560	·267	30		163
July	930	·425		349	July. . . .	690	·262		635	July. . . .	627	·280	57		94
August . . .	930	·376		401	August . . .	534	·280		244	August . . .	526	·244	36		69
September . .	813	·281		163	September .	600	·239		301	September .	714	·281	50		161
October . . .	503	·132		124	October . .	836	·273		288	October . .	572	·190	75		135
November . .	510	·127		251	November .	850	·212		622	November .	662	·152	64		277
December . .	406	·087		230	December .	600	·157		293	December . .	469	·150	57		119
Total . . .	7000	·202		2162	Total . .	5846	·177		3428	Total . .	5709	·176	577		1233

1913: Number of consumers . . 16,054
,, public lamps . 2,548

1914: Number of consumers . . 16,487
,, public lamps . 2,569

1915: Number of consumers . . 16,894
,, public lamps . . 2,575

APPENDIX NO. 2.—*Toluol and Benzol Content Extracted per 12,000 Cubic Feet of Gas.*

—	Before C Process.	After C Process.	Increase.
	Gallons.	Gallons.	Gallons.
Toluol	·046	·091	·045
Benzol	·064	·223	·159
Total	·110	·314	·204

APPENDIX NO. 3.—*Analysis of Oil Used in Atomizer and Deposited in Syphons.*

Degrees C. Per Cent. Distilled.

Sp. Gr.	120°	130	140°	150	160°	170°	180°	190°	200°	Remarks.
·770	..	..	..	*Nil*	21	47	67	81	90	Oil used in atomizer.
·850	..	1	4	10	15	19	26	35	44	Oil collected from street syphons.
·870	..	1	9	14	20	24	31	40	50	do.
·875	..	2	9	15	21	26	32	42	54	do.
·830	..	..	..	..	4	9	15	25	42	do.
·850	..	..	..	..	..	2	12	24	40	do.

Residue above 200° C. thick pasty mass.

the last speaker said regarding the pleasure it afforded them to have a paper from Mr. Simmonds. At the same time he might, perhaps, be permitted to reply to Mr. Newbigging. It was all very well for Mr. Newbigging at the head of a big undertaking to go in for vertical retorts; but they were not all circumstanced alike. His remarks were well and good if they were going to build new works and scrap existing ones; but that was going to be a costly way for some of them to get rid of their naphthalene troubles. It was a tall order to consider. From his knowledge of the author's figures, he thought he would have a very good answer to Mr. Newbigging. He (the speaker) happened to have been in the unfortunate position of having as many naphthalene cases in a day as the author reported having had in a month; and he went to Mr. Simmonds for some information as to getting relief. He had, at Stretford, the apparatus which Mr. Simmonds said he had used for twelve months; but it was not yet at work. It seemed to him that the figures which the author gave for 1915 were a very great advance upon those for the two previous years. It was quite certain that the conditions were not the same. Those members who had been extracting toluol by the "C" process had a very vivid recollection of what occurred during the months of September, October, and November, when naphthalene stoppages came in by the hundred in a day. This was entirely due to the depletion of the carriers taken out of the gas, and, in his case, the impossibility of getting the carriers which he was in the habit of adding to the gas to get rid of the difficulty. Mr. Simmonds said he had been extracting toluol; so that, to compare his figures with the previous years, they would have to take the figures on a works in which the process had not been adopted. If he (the speaker) were to correct the figures for 1915 with his own experience, he would have to add about 6000 to his naphthalene stoppages; so that, in proportion, the cases would have been the same if it had not been for the apparatus which he had in use. He considered that what the author proposed to them was something more than a palliative.

Mr. Simmonds: Have you the same number of consumers?

Mr. Kendrick: About the same. The number of stoppages were practically 7000 during the twelve months. The speaker added that he used practically every solvent he could get hold of; but it was not until he stopped tar-washing for a time, and used a heavy naphtha in its place, that he got free from naphthalene in the district. Of course, this was additional expense; and he did not keep at it any longer than was absolutely necessary. Ordinary petroleum had been mentioned to him since he had been in the room, as a possible means of getting rid of naphthalene. He found, however, that practically the whole of the petroleum (which they vaporized at the highest temperature they could get, about 100 lbs. steam pressure to the square inch) was deposited in the mains in the immediate vicinity of the works, and that practically no relief at all was obtained beyond half-a-mile from the works governors. That was to say that, within a circle of half-a-mile of the works, they had very few naphthalene stoppages. It was outside this area that they occurred. Benzene was tried, and with almost the same effect. They had, however, been in the habit of having a Scotch oil which was very much more effective for the purpose. He was sure the information the author had given them as to the very sensible method he had adopted to successfully reduce his naphthalene stoppages would be of benefit to the members. They would all join with him in thanking Mr. Simmonds for the figures and for the apparatus he had placed before them that afternoon. He cordially agreed with Mr. Newbigging, when he said he hoped they would have further interesting contributions from Mr. Simmonds.

Mr. Newbigging said that Mr. Kendrick spoke of 7000 naphthalene complaints. Did this include lamps and services?

Mr. Kendrick: Service-pipes only. You may add another 7000 on the top of that, to include everything.

Mr. F. H. Robinson (Harrogate) said that in times gone by they had had considerable trouble with naphthalene at Harrogate, but a few years ago they commenced washing their gas with a solvent at the outlet of the station meter in a washer of ample capacity. In addition to this, they had used atomized oil steam-heated, approximately of a specific gravity of about ·8. While this was in use in the summer of 1914 (which was a hot summer for Harrogate), they had a few complaints varying from 20 to 40 per day; but this was not the only trouble. They found in certain cases the meters contained about 4 gallons of a dirty brown liquid, which, after being analyzed, was found to contain 60 per cent. of water, and 25 per cent. of a liquid distilling at 90° C., and 15 per cent. of fatty matter. Then, again, they did not know whether this came from the solvent or from the petroleum they were using. However, on testing the solvent, they found that 95 per cent. of it distilled at 90° C., and the remainder was anthracene. It seemed to him that this might have some bearing on the question of the deterioration of the diaphragms of dry meters recently mentioned by Sir Corbet Woodall, and perhaps the subject would bear a little research on the part of their chemical friends, so that they could arrive at some solution of the difficulty.

Mr. S. Meunier (Stockport) said the question of naphthalene "had been a friend who had stuck closer than a brother to them." They had had it for years, but had never been able to cure the evil. At Stockport they used to be considerably troubled at one time, and found it was getting worse, or appeared to be. Following somewhat on the lines suggested by Mr. Botley, they manufactured a little apparatus of their own to deal with the trouble. The shell was formed of the outside casing of an exhaust steam-feed water-heater; and they introduced a spray, injecting oil with steam pressure of about 60 lbs. to the square inch against the flow of gas. The oil was obtained from Mr. Colson, of Leicester, who at that time was specially preparing it for naphthalene troubles. They found fairly good results, and ultimately used the same material in a Livesey washer. Both systems had an appreciable effect on the naphthalene trouble, but did not cure the evil. He was rather inclined to coincide with the opinion of Mr. Newbigging that the proper thing to do was to prevent the formation of naphthalene. He had this year made some alterations in the hydraulic mains at Stockport, and had found his method to be entirely successful. It would appear as if the necessity was to extract the heavy tars from the hydraulic main as rapidly as possible, because, as was well known, the heavy tars, if left in contact with the lighter hydrocarbons, had a powerful effect upon them, and prevented them acting as carriers for the naphthalene. It would appear to him as if the primary object of gas engineers of to-day should be to, as far as possible, allow the lighter hydrocarbons to go forward with the gas, and to endeavour to ascertain the best means of attaining the object in the carbonizing plant. One of the earlier speakers had mentioned the effect of certain materials used for curing naphthalene troubles on the diaphragms of dry meters. He (Mr. Meunier) had happened to have an analysis made of some of the material found therein, and it showed 48 per cent. of vegetable oil, with a small percentage of the lighter hydrocarbons; the great bulk being heavy oils and naphthalene—the latter being about 19 per cent. of the original solvent used. Reverting to the experiments on the hydraulic mains, the speaker said this year his naphthalene trouble had been very mild indeed—in fact, it had been so small that they had practically nothing to do in the way of complaints. It certainly appeared to him the first principle was to try to nip the trouble in the bud if possible; but, failing this, he thought the author's method of mending the trouble was a simple, and a very fine, one. He heartily welcomed Mr. Simmonds's contribution to their "Transactions," and hoped that before long he would give them some more of his practical knowledge in gas matters.

Mr. P. D. Walmsley (Wombwell) said he had listened with very great interest to the paper, and also to the remarks made by the different speakers on the naphthalene question, but he had not heard anyone suggest a remedy for effectively relieving the trouble. They had heard about various "partial remedies" for removing the naphthalene content of the gas, and these were doubtless more or less effective; but, as he had already stated, no reference had been made, as yet, to a method which would get rid of the naphthalene altogether. Members were given to understand that the production of benzol and toluol for Government purposes was of primary importance, and they had a remedy to hand whereby they could get the maximum amount of toluol and benzol from the gas, and at the same time completely rid it of naphthalene—that was, to wash the gas and completely strip it of these constituents by means of creosote oil. They, at Wombwell, had lately installed a plant for completely stripping their gas of all illuminating power, and subsequently recovering the benzol and toluol as crude benzol, which was afterwards sent away for rectification at a local rectifying plant. It was, however, their intention at a future date to instal a rectifying plant of their own, providing they could get quantities of oil to treat from neighbouring works. When they adopted the "C" process they had very numerous complaints of naphthalene stoppages; but since carrying out their present process the complaints had disappeared altogether.

Mr. S. Tagg (Preston) congratulated the author on the very businesslike paper he had given them. He rose with the object of eliciting further information. The author had given them three different tables in his appendix (1913, 1914, and 1915); and he noticed that the rough average of stoppages per day was about seven in 1913, when using "Solvene" in the Livesey washer; nine per day in 1914, when using Russian oil in the vaporizer; and only three or four per day in 1915, when using naphtha in the atomizer. But there were no figures to show the number of complaints prior to the adoption of any means for preventing naphthalene stoppages. If the author could give them some idea of this, it would enable them to judge what the effect had been of his efforts to eliminate the trouble. Was the assumption that the reduction in the number of naphthalene complaints was due to the method in which the naphtha was admitted or admixed with the gas? because the difference between 1915, when naphtha was used in the atomizer, and 1914, when the vaporizer was in use, was very striking.

Mr. J. P. Leather (Burnley) said that he had considered the naphthalene question for some time now; and a few years ago he contributed a paper on the subject at a meeting of the Institution of Gas Engineers. He investigated Mr. Botley's process, and went down to Hastings to see it. He thought there was some little difference in putting the oil into the gas as a spray, and putting it in in the form of a vapour. It did not necessarily follow that the vapour in the gas was condensed in the form of a mist. After alluding to some of the experiments he witnessed at Hastings, the speaker went on to say that he had found a perfect cure for naphthalene trouble by washing the gas with a heavy oil. He had been greatly interested in what Mr. Walmsley had said as to washing and stripping the gas of its toluol and benzol constituents by means of creosote oil. Just before that gentleman spoke, the thought occurred to him whether it was necessary, even if they produced the naphthalene, that it should go forward.

Again, he could not help thinking that a great deal of the trouble which many members had experienced since the introduction of "C" process was because they had not had their tar cool enough. If they tried to approach as near as they could to a mathematical conclusion as to what naphthalene they ought to have in the gas after washing with tar, he thought they would come to the conclusion that there ought not to be much naphthalene in the tar at a temperature of 60° Fahr. Replying to an interjection that was inaudible to the shorthand writers, the speaker was understood to say that he certainly thought it would be necessary to use something in the way of refrigerators if they were going on to extract toluol from the gas during the coming summer, and especially if it turned out a very warm summer. It had also occurred to him whether it might not pay them to have certain arrangements for cooling the gas to the temperature really wanted. This point had, perhaps, occurred to him because of the special circumstances under which he was placed regarding water for cooling.

Mr. William Smith (Bolton) said he had been interested in the remarks of the last speaker, because they had to be very careful at Bolton regarding the temperatures of the tar, and the selection of the tar. With regard to what had been said about vertical retorts and naphthalene, he thought they had had less at Bolton since adopting them. With regard to what Mr. Kendrick said about the comparisons for three years, and comparing one works with another for these periods, he did not think this was at all feasible, as varying quantities of naphthalene came forward through the difference in temperatures of the gas. It would not be quite fair to compare one works with another in that way.

Mr. F. V. Barnes (Todmorden), who also confessed to naphthalene troubles, said that if the heat of the condensers was not carefully watched, some of the naphthalene was taken out of the tar and carried forward. They had lately been adding creosote to their tar. At the same time they had altered the arrangements for the water supply and brought down the temperatures of the condensers considerably. This had helped them a great deal.

Mr. Joseph M'Nicholl (Mossley) said he desired to suggest that the success of Mr. Simmonds's process was not due so much to the method of application, or to the solvent used, but to the fact that, instead of using a stream of gas as in the Maxim process of carburetting, he employed air, which, in his opinion, acted as a carrier for the solvent. When the gas was used it was quite possible that its composition was such that it was incapable of carrying forward any vapours or spray.

Mr. R. H. Garlick (Salford), speaking from the distributing engineering side of the question, said that at Salford they had had naphthalene troubles to contend with, but had cured them to a large extent. They found certain material in the mains which their chemist had analyzed and said it was due to cyanides having some action on the mains and depositing certain material which dropped down and came into contact with an oily substance—something in the nature of treacle, but not quite so dense. Had the author had any troubles of this sort? They had in their district about 74,000 consumers and 10,000 lamps in an area of about 40 square miles, and were generally troubled with naphthalene during April and October. In 1914 they had only 172 complaints—quite a phenomenal year; and in 1915 they reduced this to 159.

Mr. Robert Watson (Doncaster) said as one more or less concerned with naphthalene tronbles, and interested in palliatives, the discussion had proved most interesting to him, especially the reference to the trouble with the diaphragms of dry meters. As the author had had three years' continuous experience, he would like to know to what extent his dry meters had been affected. It seemed to him this proposition was going to be a serious one for the future—and a problem accentuated by the fact that they had adopted the "C" process for taking toluol out of the gas.

Mr. H. E. Bloor (York) said he should like to ask whether it was quite fair to draw such a definite conclusion from such a short experience. The author had given them the figures regarding naphthalene stoppages under three different processes for the three years past—2162, 3428, and 1233. To him (the speaker) the figures did not seem to provide a sufficiently clear line of demarcation for them to say that the process before them was responsible for the alteration. Had the number of stoppages been 233 instead of 1233, or rather in tens instead of hundreds, it would have given them a more definite indication. As Mr. Tagg had said, there were no figures in the paper showing the number of complaints prior to the adoption of any means for preventing the naphthalene troubles. It would, therefore, be interesting to hear what these figures were, as he would like to be assured that the difficulties in 1915 were not accounted for by any other circumstances. With regard to toluol (this matter did not arise out of the paper), the speaker thought they ought to be in possession of some authoritative information before the summer as to whether they would be wise in washing by the "C" process. In his (the speaker's) opinion they would do no harm whether they went on attempting to extract the toluol; but it should be possible to get to know something really definite upon the subject. He hoped that inquiries would be made into the matter.

Mr. Samuel Glover (St. Helens) said he had been interested for a long time in the subject of naphthalene, its prevention where possible, and cure where it persisted in occurring and recurring. He thought he had been interested in the question ever since the investigations were published of Messrs. Botley, of Hastings, and the other authors to whom Mr. Simmonds alluded in his paper. The author had that afternoon also gone back to the work of the late Mr. William Young, who, along with himself, and at his suggestion, was the first to determine that to prevent stoppages in the distributing mains and services and lamps of a coal-gas works, it was necessary to associate with the gas the vapour of an oil of the same vapour tension as the naphthalene in the gas. This was, he thought, some little step in the direction of defining clearly the principle upon which it was necessary to act to overcome the naphthalene trouble, where it was present in such a quantity as was likely to lead to its deposition in the mains and services. He was rather afraid that, because some of these papers had not been sufficiently noticed and studied by the present generation of gas engineers, the subject had had to be brought before them again that day; and some of them had had to begin to study the subject as if no paper had been written on it before. They did, however, want to get down to the basic facts, and to do what Mr. Newbigging had said—stop naphthalene production. Then they would have taken the best means to get rid of the trouble, on the principle that prevention was better than cure. He did not want anyone to go away from the meeting disappointed that some members could do things at their works, by certain oils and certain methods, which they themselves could not, and feel that they had not realized any benefit from the meeting. Naphthalene in some of their areas had run a very long way from their works into the districts; and they could not turn on a tap one day at the works and hope that the trouble they had accumulated for many a day was going to be cured quickly. The author said he had tried many processes for the cure of naphthalene. He (the speaker) thought he said he had tried three processes; but his view was that he had only tried, in a measure, some processes in his own way for his own district. The 1913 plan was a method applied in one way; 1914 was another medium; and then he came forward in 1915 with a further process worked in another way. This time he applied the process at a point where it was more likely to tell directly on the district, because he was applying it into the main that was conveying the gas directly on to the district, and not, as he was in 1913 and 1914, into the inlet of the gasholder, where possibly considerable quantities of oil used were deposited, as shown by the action of the "Solvene" on the paint of the gasholder. He did not want to criticize Mr. Simmonds's process in any censorious way, as he felt he was looking for the truth, and would be willing to look at all sides of the question. With regard to Mr. Leather's remarks, he could not help but think that he had been speaking about the atomizing of petroleum. He (the speaker) could not imagine that any atomizing process could atomize so thoroughly as a vaporizing process. What was a vapour? It was a mist of atoms and of oil vaporized. A member had remarked that it was really "mysterious." Exactly so; but they wanted to do away with mysteries and get down to simple facts. Mr. Simmonds's statistics showed that in the year 1913 not much good was done by the application of "Solvene" in the washer. In that case the tar would run off, and the "Solvene" be absorbed in the tar, for the latter would, undoubtedly, absorb a very large portion of the former, and leave only the remainder to act upon the naphthalene. The best way for a complete mastery of the problem was perhaps to wash on the works in such a way as to prevent trouble in the works, and to vaporize on to the district along with the gas going out suitable quantities of suitable oils to prevent any trouble on the district. Talking about "mists," tobacco smoke when seen under the microscope was a mist of fine globules of moisture and vaporized smoke. A vaporizer on the whole atomized better in its application than any mechanical atomizer could possibly do. It struck him that Mr. Simmonds's quantity of naphthalene was not very high, but yet had not been able to remove the whole of it. He (the speaker) did not think the author would be willing to rest content until he had got rid of the trouble altogether. They looked forward to hearing from Mr. Simmonds later on that he had been able to evolve a method that would cure the varying complaints arising from naphthalene deposits. In regard to the question of dry meters being affected to some extent, the suggestion that chemists should turn their attention to this phase had been anticipated, and the meter makers themselves had taken the matter up. The Institution of Gas Engineers had also interested themselves in the matter, and in a short time they would hear more about it.

A Member: When?

Mr. Glover said he could not say when. Mr. Bloor and others had expressed the anxiety in their minds as to toluol extraction during the summer. The Committee of the Ministry of Munitions last week had this matter before them; and he could tell them now, authoritatively, that the Munitions Committee were looking for the greatest help from gas engineers throughout the United Kingdom to produce toluol and benzol in as large a measure as possible, and hoped that they would secure for themselves now such control of matters in their works as would enable them to wash by tar all through the summer without the trouble that was experienced last summer. He particularly desired to emphasize the fact that the Munitions Committee were looking forward to all gas engineers to turn their skill in this direction.

Mr. J. H. Brearley (Longwood) asked whether members would be circularized to this effect by the proper authority.

Mr. Glover replied in the affirmative. He was only too glad to have been present that afternoon in order to let them know in the North what was required of them, so that they could get ready.

Mr. R. G. Shadbolt (Grantham) addressed the members on the question of reducing temperatures in summer; but his remarks were hardly audible at the Press table.

The President intervened in the discussion at this stage, and said it must be concluded on account of another urgent question having to be brought before the members. Mr. Simmonds could not other than be gratified by the reception given to his paper, for it had led to a most interesting, if lengthy, discussion.

Mr. Simmonds, in the course of a brief reply to the questions, said the bulk of the gas made in the last three years had been with the De Brouwer machinery. For two or three months in the winter, however, they used the No. 2 retort-house, where the charging was by West's machinery, exactly under the same conditions as the De Brouwer, and with nearly full retorts. With regard to the figures of naphthalene stoppages, he had only given those for 1913, 1914, and 1915, because he thought they would be sufficient for the purpose. If he had quoted statistics showing what he had gone through during the eighteen years he had been at Bury, he was afraid he would have given them a very weary time. He thought no one had had more trouble than he had experienced. Last year (1915) was the best he had had since he had been at Bury for the smallness of naphthalene stoppages; and he merely showed the figures for the three years, so that members would see what the comparative results were. If he went back for (say) nine years, the average number of stoppages would be practically the same as those he had stated. At certain seasons of the year, they probably found a number of complaints coming together; but there was nothing unusual in this. With regard to Mr. Tagg's query, he could only point to the fact that the experience of 1915, when using naphtha in an atomizer, had certainly gone a long way to curing their troubles; and he thought that if he were to put a little more oil in, he could do away with complaints of naphthalene altogether. He whimsically declared that he would not like to be without complaints altogether; for complaints brought one into touch oftener with a consumer, and they might embrace the opportunity of supplying him with a gas fire or a cooker. He had not found any damage to the diaphragms of dry meters in his district. Another reason why he claimed that they were better this year than previous years, was that they were taking out of the gas 20 gallons of light oils per 100 tons of coal carbonized. As a matter of fact, they were not taking toluol out of the gas; they were putting it in. A question had been asked as to why he did not use steam instead of compressed air. He thought it would not be advisable to use steam, because this would increase the moisture in the gas, and moist gas had more tendency to deposit naphthalene than dry gas. It had afforded him much pleasure to fall in with the wishes of the retiring President to read a paper. He had contributed it more with the idea of giving them his own experiences than of telling them how to get rid of naphthalene. He thought the experiences he had had might possibly be useful to other members.

Gas-Power Driving in Textile Factories.

An engineering correspondent of the "Manchester Guardian," referring to the question of deciding upon the type of motive power to be adopted in building or re-powering textile mills in Lancashire, says this problem becomes increasingly difficult with each new improvement that is offered. After referring to the cost of running steam-power plants and electrically driven installations, the writer states that the probable cost of purchased electric current in the future is good subject-matter for speculation. It is, he says, unlikely that the low fuel prices of four or five years ago will ever return. Coal costs constitute an important item in electrical stations; and, if not quite so important in relation to total costs as many people imagine, it is beyond question that recent increases have caused power-station engineers grave anxiety, and have in many cases turned credit into debit balances. It is more than likely that purchasers of power-current will have to pay somewhat higher rates for a few years. On the other hand, we look forward in the near future to reductions through another channel. The extraction from coal of its valuable chemical products has been discussed for many years. Even at present coal prices, the value of these products may equal or exceed that of the raw fuel. Sooner or later their recovery will be universal. This is no idle theory. The possibilities are fully demonstrated in public electric supply stations run on blast-furnace and coke-oven gas on the North-East coast; on producer recovery gas (as at Accrington); and by similar procedure at numerous coal, iron, and chemical works in the country. The last eighteen months' experience has emphasized to scientific and commercial minds the folly of permitting present wastage of our most valuable national asset to continue; and a crusade has been inaugurated, with Professor W. A. Bone as chief expositor, to make the actual facts more widely known.

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Suction Producers and Bituminous Coal.—An account was given of a suction-gas producer using bituminous coal by Mr. R. V. Farnham, at a recent meeting of the Institution of Engineers and Shipbuilders in Glasgow. He pointed out that, because of its low ash content, anthracite was chiefly used in suction and pressure gas producers up to 500-H.P. Coke was troublesome to gasify; and the calorific value was only 10,000 to 11,500 B.Th.U. per pound, compared with 14,500 B.Th.U. from anthracite. He considered the gas-engine for marine work would never succeed, if it depended only on non-bituminous coals; and he referred to experiments made on the "Farnham" type of engine and producer, which was designed to gasify ordinary bituminous coal, the cost of which was 13s. to 20s., against 30s. to 40s. per ton for anthracite.

FUNDAMENTAL PRINCIPLES OF GOOD LIGHTING.

This was the title of a paper by Mr. P. G. Nutting, read at the recent meeting of the National Commercial Gas Association of America—the eleventh annual convention held at Washington. The paper was a very long one; but the author did something to atone for this by saying that, in view of the "discursive treatment given to the subject," he had prepared a summary (as follows) of the various principles discussed.

The eye is our sole means of judging whether illumination is satisfactory or defective. The desirable properties of light sources, and of the field illuminated, depend upon the properties of the eye which is to view that field.

Lighting such as to produce a mean brightness level higher than 1 lambert* is excessive under all conditions. A brightness level under 0·1 millilambert is too low for the use of the eye for any purpose requiring discernment of detail.

With but moderate contrasts (20 : 1 or less) within the field of view, and work requiring no greater attention than reading, there is but little to choose between a mean field brightness of 1 and 100 millilamberts. For work requiring close attention, such as drafting or needle work, the most desirable brightness is about 10 millilamberts.

The greater the contrasts with the field or view, the higher (10 to 50 times) the mean level of brightness instinctively demanded by the eye.

There are four levels of brightness of chief interest to the illuminating engineer: Exteriors in daylight (mean level 1000 millilamberts); interiors in daylight (10 m.l.); interiors under artificial illumination (0·1 m.l.); out of doors at night 0·001 m.l. The instantaneous threshold and the retinal sensibility (threshold, contrast, and glare) are given for each level.

For interiors, no illuminant within the field of view should be brighter than 250 millilamberts, and no contrast should exceed 100 : 1.

Glossy furniture, dark furniture, and dark shadows are to be avoided, on account of the excessive contrasts which they are liable to introduce.

The distribution of brightness in an interior is preferably in the proportion of 100 at the ceiling to 30 to 40 at the eye level and 10 to 20 below the eye level.

Rapid alterations in brightness are not to be tolerated unless more rapid than 40 per second.

Quick changes in brightness over wide ranges are to be avoided. These may produce mere discomfort, temporary injury, or permanent injury to the eye.

The whole discussion has been an attempt to elucidate the principles of efficient lighting—efficient in the double sense of making the best possible use of the light and efficient in enabling the eye to operate under the most favourable conditions. Extremists have on the one hand tolerated any lighting that did not cause permanent injury to the eyes, and on the other have raised trivial objections to even minor causes of discomfort. The author has no sympathy with either view; what should be done in his opinion, and what is worth best consideration and effort, is the relief of over-worked and much-abused eyes from the wear and tear of the bad lighting conditions which have been put upon them. It would be unwise and unnecessary to relieve them of all discomfort at all times—that would surely result in a deterioration of the adaptability of the eye itself. The standard in his opinion should be the comfort of out-of-doors daylight lighting; abundant light well diffused and (by far the most important) but moderate contrasts anywhere. Under tolerable lighting conditions, the eye is wonderfully adaptable and efficient; and it is to be hoped that within the near future it will be relieved of the many trying conditions under which it is now called upon to operate.

Dutch Consumption of Coal-Tar Colours.—A Central Coal-Tar Colours Commission has been formed at Amsterdam, says the "Chemical Trade Journal," as a result of the recent decision of the German chemical-works to increase the prices of coal-tar dyes by 400 per cent. and only to accept payment in Dutch currency on the basis of the rate of exchange which prevailed in normal peace periods—namely, 100 florins for 170 German marks. It appears that the action of the German chemical companies was imposed by the German Government. At the recent meeting when the Colours Commission was constituted, about 100 representatives of consuming industries from all parts of the country were present. It was pointed out that Holland had hitherto depended almost entirely upon Germany for her deliveries of coal-tar colours, and that the new situation of affairs could not so remain. Most of the firms represented were inclined to pay the higher prices under protest, while at the same time it was agreed to ask the Government to adopt corresponding measures. The Commission were charged to collect data for submission to the Government in connection with suggested negotiations with the German Government.

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* The lambert is the unit of brightness recently adopted by the Illuminating Engineering Society. It is the brightness of a perfectly diffusing surface radiating or reflecting one lumen per square centimetre. Brightness expressed in candles per square inch may be reduced to lamberts by multiplying by 0·4868. Brightness is, it is claimed, preferably expressed by lamberts not only because of the brevity of the name, but because of the apparent ambiguity of other terms in many cases. It is difficult, for example, to think of the brightness of the sky in actual candles per square inch.

COKE-OVEN MANAGERS' ASSOCIATION.

WAR PROBLEMS IN THE COKING INDUSTRY.

A Meeting of the Coke-Oven Managers' Association was held at the Department of Applied Science of Sheffield University, on Saturday evening, under the chairmanship of the President (Mr. George Chrisp), when a paper was read by Mr. G. Stanley Cooper, B.Sc., on "Some Difficulties Due to the War; and Possibilities of Future Development."

The President, at the outset, congratulated those present upon the excellent attendance, in view of the wretched weather conditions (heavy snow). The thanks of the Association were particularly due to Mr. Stanley Cooper for having got the Council out of a difficulty in obtaining a reader of a paper for the meeting, by bringing his own paper forward by a month. This meant, of course, that he had been seriously handicapped in the hurried preparation of the paper; and if there should be found any little deficiencies, the reason would be understood.

Mr. G. Stanley Cooper then read the following paper:

The original suggestion by the Council with regard to this paper was that it should deal with methods of using arsenical sulphuric acid in the manufacture of sulphate of ammonia; but I felt that, in spite of the importance of the subject, I could not make a full and satisfactory paper on this topic alone. Difficulties there have been in many directions; and I propose to deal only with some of those associated with the operation of bye-product coke-ovens, and not with the constructional side. Naturally, sulphuric acid looms largely in our minds at present; and I believe that the difficulty in this connection will get worse, instead of better. Arsenical B.O.V. is being largely supplied now to sulphate makers; and although the amount of arsenic does not generally exceed a maximum of 0·1 to 0·2 per cent., the effect of even this small quantity is very marked on the colour of the salt. I am not able to ascertain if it has any serious detrimental effect from the biological standpoint when arsenical sulphate is used as a manure; but I do believe that much unnecessary fuss is made of the arsenic question. We must, in the first instance, look to the manufacturer to take all possible precautions to reduce the arsenic to a minimum, as by careful control of the manufacturing process the arsenic certainly can be reduced. Flue dust from the burners at times contains an appreciable amount; while the mud deposited at the bottom of the Glover tower frequently contains much arsenic.

Eliminating Arsenic from Sulphuric Acid.

Many methods of removing arsenic from B.O.V. have been tried, with varying degrees of success; but the majority are inapplicable for coke-oven adaptation. The only method which offers any inducement to coke-oven people is the precipitation of the arsenic as sulphide, by means of sulphuretted hydrogen. This method also removes other impurities—such as lead, cadmium, &c. We have on coke-oven plants practically an unlimited supply of sulphuretted hydrogen; and this can be employed for the direct precipitation of arsenic. On a strong acid, however, the action is to produce sulphur, which is difficult to separate, and ultimately finds its way into the sulphate of ammonia.

On many direct recovery plants, it is a practice to allow a little tar to pass forward into the saturator. The arsenic is precipitated as sulphide; and the precipitate is collected by the tar and retained as a scum on the surface of the bath. The acid in store can be treated in a similar manner—bearing in mind, of course, that its strength must not be excessive. A good strong mother liquor, containing about 25 per cent. of free acid, and unsaturated with sulphate, can be fairly satisfactorily treated by H_2S. Where an ammonia still is in use, the effluent gases can be made use of to some extent, as they are rich in H_2S; and this method has the additional advantage that all the ammonia is recovered. The mother liquor needs to be in an enclosed vessel, provided with a gas inlet and outlet; and a sufficient quantity of thin tar should be added to form a layer about $\frac{1}{2}$-inch in depth. It is also desirable to provide some means of running off the tar periodically. The efficiency of the method is shown by the results of some experiments carried out for me by Mr. G. E. Foxwell, of Sheffield. The tests were made on a saturated solution of sulphate of ammonia, to which had been added 10·9 per cent. of sulphuric acid; the acid being of 142° Twaddel, and containing 0·2 per cent. of arsenic. The solution of sulphate of ammonia, therefore, contained, in every 100 grams, 0·028 gram of arsenic. A portion of the solution was taken and covered with a layer of tar of about $\frac{3}{16}$ inch, and H_2S passed through for a considerable time. The tar was then separated; and the arsenic was estimated in both the liquor and the tar. The total sulphide equivalent of the arsenic taken was 0·036. In the tar was found 0·028, and in the liquor 0·003—there being a loss of 0·005 unaccounted for. This shows that the arsenic was reduced to about 8·5 per cent. of the original amount. As I am not making sulphate just now, I have not had the opportunity of instituting special trials. But I have found from previous trials that a considerable proportion of arsenic is eliminated; and this is the only practical method I am aware of by which it can be done.

Substitution of Nitre-Cake.

Most of the members will have received a circular from the Ministry of Munitions concerning the substitution of sulphuric acid by nitre-cake in the manufacture of sulphate of ammonia. In connection with this and other matters of a similar nature, introduced by the Ministry of Munitions to coke-oven people, it is high time that this department had someone to advise it who really understands bye-product coking from the practical point of view, and who realizes what some of the fantastic propositions put forward occasionally really mean when applied on the works. The bye-product coking industry is one of the most important of the munition industries; yet, as far as I am aware, there is not a single practical coke-oven man on the staff of the Ministry of Munitions, and we are absolutely at the mercy of amateurs, theorists, and cranks whose sole qualification for the post they hold is an "open mind," which, at the same time, is absolutely ignorant of the real points at issue. We know how the Government have bungled things with regard to sulphate of ammonia.

The suggestion for using nitre-cake in the place of sulphuric acid is not new; but the Government tackle it from the wrong end first. You will have seen what the proposal means. They say that the sulphate produced by this method will contain 15·4 per cent. of sulphate of soda—thus reducing the ammonia content down to about 18 per cent.; while the free acid will be 1·4 per cent.! In the first place, What about bags with this acid content? Some years ago I experimented with nitre-cake for the same purpose; but I could never reduce the sulphate of soda down to anything like 15 per cent., and I do not think that in the hands of an ordinary sulphate man anything like this figure can be attained, or continuously maintained. The principal questions that arise are:

(1) Can the mixed sulphate be sold?
(2) How will the wear and tear of plant be affected?

The first of these questions is, presumably, ignored by the Government; and the second is very lightly passed over. To my mind, it is an open question whether it is better to adopt this method or to make as much sulphate as possible by the ordinary process, and waste the rest of the ammonia, or recover it in some other form. I do not think the process is at all suitable for either direct or semi-direct plants, as to work these with the liquor at boiling-point would be highly detrimental. On the other hand, if the temperature is below boiling-point, an excessive amount of sulphate of soda is deposited. The process certainly cannot be launched into general practice in the off-hand manner which the Government circular suggests. Again, you will probably have noticed that the men on whom this process is to be dumped are quite overlooked in the Committee appointed to discuss the question. I suppose we must suffer by their inexperience. But certainly, wherever possible, other methods of dealing with the ammonia should be adopted.

Other Methods of Dealing with Ammonia.

The manufacture of nitrate of ammonia is out of the question, as nitric acid is more difficult to obtain than sulphuric. Ammonium chloride occurs in all ammoniacal liquor; and, although I would not in general advocate recovery of this, under present conditions it is well worth consideration. The production of crude ammonium chloride is comparatively simple; but the manufacture of pure salt is not easy under ordinary coke-oven conditions. The most attractive propositions are: (1) The manufacture of liquor ammonia, or pure ammonium hydrate; and (2) the manufacture of concentrated ammonia liquor. Of these, the latter is by far the simpler process. As an offshoot of the former, one firm has developed the manufacture of cloudy ammonia, used for washing purposes. For this, the liquor is distilled in the usual way, and the ammonia gas purified and absorbed in water to the required strength. The cloudy effect is usually obtained by the addition of soft soap. This process is, however, by no means as simple in practice as it looks on paper. The loss in manufacture is frequently high; the apparatus is somewhat complicated, and occasionally difficult to work efficiently; and the demand for the product is not unlimited.

Much more can be said on behalf of the manufacture of concentrated ammonia liquor containing about 15 per cent. of ammonia. In this case it is not always necessary to eliminate CO_2 and H_2S, though if these (and particularly the latter) are reduced, a higher price can be obtained for the liquor. The apparatus is not complicated; and the process itself is comparatively simple. The ordinary ammoniacal liquor is distilled; and the steam, ammonia, carbon dioxide, sulphuretted hydrogen, &c., are condensed by means of a water-cooled condenser. The amount of steam must be regulated in order to supply just sufficient condensed water to dissolve the ammonia, &c., and to maintain the strength of the condensed liquor at about 15 per cent. of ammonia. Concentrated liquor exerts a moderate pressure at ordinary temperatures; so that great precaution is necessary to avoid undue loss of ammonia. As the liquor runs into the storage tank, the displaced air will carry away with it some ammonia; and in order to prevent losing this, I connect-up the outlet pipe on the tank to the suction side of the exhauster. Any ammonia, therefore, passes again into the scrubbers.

The principal (and indeed the only) trouble usually experienced with this plant is the blocking-up of the condenser tubes by ammonium carbonate. In order to obtain a satisfactory effluent liquor, more steam has to be put into the still than is necessary to supply the amount of water required to form the concentrated liquor. A reflux condenser must therefore be employed, in order that the water content of the distillate can be regulated. With such reflux condenser the strength of the concentrated liquor can be regulated as desired. As conditions are not always absolutely constant, the strength of the liquor will occasionally rise above 15 per cent.; and it is then that trouble with blocked pipes begins. With about 20 per cent. of ammonia, the liquor will solidify at ordinary temperatures; so that the condenser needs to be carefully watched at such times. Constant testing is, therefore, necessary in order to keep the liquor at the proper strength.

The way in which the ovens are worked with regard to suction has a very marked effect on the working of the concentrated liquor plant, which at first sight is not very apparent. With suction on the ovens, air is drawn in and carbon is burned. The amount of CO_2 in the gas is thereby considerably increased. This again results in the formation of more ammonium carbonate in the ultimate concentrated liquor; and the liability to blockage increases accordingly. By working our ovens at a rather higher pressure than usual, we have found that carbonate troubles have disappeared, as neither air nor flue gases are drawn in.

Many processes have been suggested for the partial elimination of CO_2 and H_2S; but the majority are unsuitable for ordinary practice, on account of unnecessarily complicating the apparatus. By preheating the liquor, partial elimination of both CO_2 and H_2S can be obtained; but at the same time some ammonia is also drawn off. To make it worth while, the liquor must be preheated to at least 95° C.

The following table shows the amounts of ammonia, carbon dioxide, and sulphuretted hydrogen eliminated at various temperatures with a particular liquor.

Composition of liquor:

Free ammonia	0·92 gm.	per	100 c.c.
Carbon dioxide	0·86	,,	,,
Sulphuretted hydrogen	0·122	,,	,,

Quantities eliminated per 100 c.c. of liquor:

	Temperature.		
	85° C.	90° C.	95° C.
Ammonia	0·054	0·10	0 152
Carbon dioxide	0·158	0·16	0·304
Sulphuretted hydrogen	0·069	0·071	0·074

The same test carried out under a suction of 60 mm. of mercury gave the following results:

	Temperature.		
	85° C.	90° C.	95° C.
Ammonia	0·061	0 132	0·196
Carbon dioxide	0·184	0·203	0·378
Sulphuretted hydrogen	0·072	0·074	0·078

DISPOSAL OF PITCH.

The accumulation throughout the country of large quantities of pitch has caused a slump in this product, which has had a corresponding effect on the price realized for tar. The question of the carbonization of pitch in coke-ovens has been brought to notice as a possible means of reducing stocks, and of so helping to improve the outlook for tar. The proposal is that a proportion of pitch should be mixed with the coal before charging. The effect, it is said, would be to improve the quality of the coke, and also of the gas; while there is also the possibility of other advantages. The whole subject is at present under investigation; and I would urge those of you who are in a position to do so, to make a trial—using (say) 5 to 10 per cent. of hard pitch well mixed into the coal. Experiments, both on a small and a large scale, have been made; and the results are distinctly encouraging. You will, I think, all agree that if the position with regard to pitch can be eased at all, it will be a great benefit to tar producers.

PROFESSOR BONE AND TECHNICAL RESEARCH.

In connection with this subject, it seems opportune to refer to the possibility of State co-operation in technical research. Professor Bone has frequently called attention to the urgent need for the establishment of a national bureau to deal with questions of fuel economy and allied matters. We can easily imagine that a great deal of good would result from such an establishment; and in the hands of the right men, it would prove to be an inestimable boon to the country. But we must have practical men—men who know the industry thoroughly, and who are fully aware of the nature of all the difficulties and problems we have to face.

BENZOL RECOVERY.

One could not, under present circumstances, omit some reference to benzol recovery. Fortunately, I believe operation troubles are comparatively rare in this connection. But in some cases there has been a difficulty in obtaining supplies of suitable scrubbing oil. In my own case, by careful attention to the elimination of naphthalene from the oil, I have been able to prolong its working life very considerably. In view of the importance of benzol in the present crisis, it is rather surprising that we have not had some official guidance with regard to the best method of working our plants to produce the largest yield of benzol, &c. I do not propose in this paper to go into any great detail on this point; but I think the subject is one worthy of close attention, and I hope to stimulate some discussion on it. I consider the first step which the Ministry of Munitions ought to have taken was to appoint a Committee of practical men to investigate the question, and give us all the benefit of their investigations. They should tell us not only what to do, but how to do it.

I would like to revert for a moment to a topic which I previously introduced at one of our meetings—viz., the recovery of crude benzol of less than 65 per cent. In my opinion, it is little short of criminal at the present time to make 65 per cent. spirit; yet we are more or less tied to it by custom and convention. We know perfectly well that when the gas is scrubbed by creosote oil, &c., the latter extracts a variety of products. The general maximum temperature to which the oil is distilled for the recovery of these products is about 135° C. Now we also know quite well that the distillate so produced in the majority of cases is not 65 per cent. spirit, but something less than this. To make it into 65 per cent. spirit, we have to dephlegmate a portion of the vapours, which portion is run back into the scrubbing oil. The returned portion almost invariably contains both some benzene and some toluene; and I contend that we are doing wrong in not recovering it. We ought, in my opinion, to recover the whole of the distillate as produced; and we should get the same price for it as we do for crude benzol at present. If our usual buyers will not deal with it, the Government ought to make them. On every hand we are told that more benzol and toluol are required. The result of the adoption of this proposal will be a net increase in the toluene production of several per cent.

But the Government will not even deal with what benzol we have got, let alone take steps to deal with what might be recovered. For several weeks now I have carried a stock of over 10,000 gallons of benzol; and I am absolutely unable to get it moved. Our buyers blame the railway, and the railway blame the Government. Drastic action is required somewhere. When I applied for special labels for the conveyance of benzol, &c., I was told that no special labels were required, as tank-waggons were always given preference. As it takes over a week for my tar-tanks to travel about six miles down the line, one wonders where the preference comes in, and how long it takes to get ordinary traffic over the same distance.

I would like to press, therefore, the need for some concerted action on the part of the Association in these matters. What can we do to assist the production of an increased quantity of benzol? We can express our opinions as to the best conditions for its formation, and assist one another by giving our experience of our own working. Chemically speaking, benzol is a high-temperature product; and I have found that our yield is substantially increased when carbonizing at a high temperature. The naphthalene also is increased; but I do not think this is any detriment. I have heard the opinion expressed, on the other hand, that it is a distinct advantage. Working the ovens at a pressure of about 5 mm. in the collecting main, I have found to be most satisfactory. Suction on the ovens appears to me to be decidedly against a high yield of benzol. The effect of moisture is, I think, also slightly detrimental. In tests which I have carried out on the same class of coal, the best results were obtained from dry coal. At the same time, I would point out that it has been found that the illuminating value of coal gas is higher from wet coal than from dry; and it is urged, therefore, that the gas from the former is richer in benzol than that from the latter. If, therefore, in the subsequent discussion we can throw any light on the formation of benzol, we shall render a distinct service to the country.

Discussion.

The CHAIRMAN thought they would all agree that they had a paper before them which opened up unlimited possibilities for discussion.

Mr. E. M. MYERS (Staffordshire) first of all voiced the indebtedness of the members generally to Mr. Cooper for his trouble in picking up and piecing together the threads for such a paper as he had given them. Personally, he (Mr. Myers) was particularly interested in the subject of pitch. He had tried experimenting—probably some eighteen months ago—with pitch, mixing it in proportion of 5 per cent., 7½ per cent., and 10 per cent. of coal. Although he did not intimately mix—that was, put the pitch into the disintegrator and mix it with the slack, as some people did—he must say he did not get very encouraging results. He found that when he rose to the height of 10 per cent. of pitch mixed with the slack, the moment the coal was charged into the ovens it was impossible for the men to get anywhere near the place to put the lids on. The great volumes of flame and smoke were tremendous; and as to its effect on the coke, he found no appreciable increase or decrease in the quantity of breeze to warrant him going to the trouble of mixing the pitch with the coke. He thought some means ought to be tried of mixing the pitch with small coke; and he believed a very good market might be found for the disposal of either briquettes or whatever they like to call them. He did not see why English railways—as had been done in Belgium—should not be forced by the Government to use patent fuel. He believed several people had gone wrong in trying to manufacture such fuel; but he did not see why it should not be found possible, by some means, to make it a marketable success. In any case, on his own works, the pitch difficulty was an alarming one. It required a tremendous amount of storage space and expenditure of labour to find a place suitable to keep the pitch out of the pitch beds, and so enable them to work their tar plants. He supposed all tar distillers had received the circular from the Ministry of Munitions, asking them to do this thing. He was looking forward to learning something as to how to do it. Another point to which he could not help referring (though he believed he had made mention of it on several previous occasions) was the question of ammonium chloride. In all coals to some extent, and in some coals particularly, ammonium chloride existed—in their case, as ammonium chloride. Why should they not recover it as such, instead of distributing it as ammoniacal liquor? He thought this was a matter which should occupy some attention. As Mr. Lee had remarked on a previous occasion, the system which prepared and which recovered its products in the manner in which they were formed, without splitting them up, would succeed where other methods and systems which sought either to split up or add to their products, would not succeed. He did not see why it should not be the aim and object of everybody connected with the recovery of ammonia—and, as he had said, all coals gave off quantities of ammonium chloride in greater or lesser degree—why this salt, for which there was a ready market in some parts of the world, if not in this country, should not be recovered as it was? He would be glad of any information as to how to produce ammonium chloride in a marketable form, suitable for use either in this country or elsewhere.

Mr. Cooper said, with regard to the use of pitch, he found exactly what Mr. Myers had said was correct in reference to the smoke and flame. This was, to some extent, dependent on the condition of the pitch; and he found that intimate mixing had a lot to do with success in the matter. If it was intimately mixed, they did not get the flame and smoke up to quite the same degree. Of course, the quality of the pitch entered into the matter. It had to be an extremely hard pitch, which meant, of course, that the lighter constituents had already been removed. The matter of the men with whom they had to deal was a difficulty which they had to get over, and particularly at the present time. He had known a case of a man who thought he would have as near as possible a pitch coke, but unfortunately some of it ran out of the door. This was one of the troubles consequent on bad mixing. With an inferior coal, the quality of the coke was frequently improved. It must be so in either case. There might be special circumstances making difficulty; but he was convinced that there were possibilities in it. It was worth investigation. With regard to the recovery of ammonium chloride, he quite agreed with Mr. Myers. It was foolish to start with ammonium chloride, and then split it up into something else. On the other hand, this was the routine of progress. They always started at the wrong end first. With regard to the tar. Why condense it at all and redistil it? Why not take the fractions out? He thought that ultimately this would be done. The late Dr. Feld had a process for doing it, and he got some distillates quite as good as some of the distillates which were now being worked. They must bear in mind that because they happened to appear to be going wrong now, it did not follow that they would always go the wrong way. As they were situated at present, he did not think the recovery of ammonium chloride was "worth the candle." It was a question, after all, of "*£ s. d.*," with which they had to face their directors. If they achieved something which was a beautiful ideal, but which did not show a dividend, they did not get much sympathy. In the majority of cases, as they were situated at present, the recovery of ammonium chloride direct was not the most satisfactory way of dealing with it. At any rate, however, it was far preferable to dealing with nitre cake.

Mr. J. W. Lee: Might I ask if the pitch question is worked on the same basis of "*£ s. d.*"?

Mr. Cooper: Yes. To my mind the improvement you get out of it is not worth bothering with except from the "*£ s. d.*" standpoint. It has to be purely on such a basis, and unless the pitch question is sound from this point of view, I do not think it is worth bothering with at all.

Mr. Lee: That was my question. Is it sound? Reckoning pitch at what?

Mr. Cooper said at 10s. a ton. It depended very largely on local circumstances. They could work it out for themselves for what they could get the pitch at their works at, and what it was going to cost to handle it. There was a possibility in just coking pitch alone if they were going to get satisfactory coke.

Mr. Lee suggested that it was on very few works that it was satisfactory from the point of view of "*£ s. d.*"

The President said he had had it rammed-down his throat—and he thought they all had—that this was a matter of patriotic requirement, rather than one of money. Personally, he did not think it was satisfactory from the money point of view.

Mr. C. P. Finn said it seemed to him the Ministry of Munitions had, from a national point of view, made a false step in urging the use of pitch. He should have thought they were more concerned in the carbonizing of as much coal as possible, and the recovery of as much benzol as possible. Supposing they took 10 per cent. as the proportionate substitution of pitch for coal, if they were charging 300 tons of coal per day, that was 30 tons of coal substituted by pitch. They did not get the equivalent of crude benzol per ton of coal, and they were not really helping the Ministry of Munitions in producing an article which was badly wanted. He sympathized with Mr. Cooper when he said they ought to get the same price for 60 per cent. benzol as for 65 per cent.; but when they saw in the United States such prices as $6 per gallon were being paid for crude and $3 and $4 for benzol, they began to think they were being a bit hardly done by in this country. With regard to the question of sulphate of ammonia, and effecting economies in the use of acid by substituting nitre cake. He supposed anybody who had a benzol rectification plant to deal with would be using the waste acid for benzol washing. He was doing so. He might say that the use of the acid caused a marked improvement in the appearance of the sulphate produced. It was whiter and cleaner in appearance; and the men themselves, if one said to them: "That looks a bit darker than it has been," would reply: "We have not had as much of that dirty acid lately." He supposed it was an old dodge—it might be an exaggeration—that some old tar makers in the neighbourhood of plants used to buy acid tar for the purpose of making cleaner sulphate. With regard to nitre cake, he had been making sulphate of ammonia from nitre cake for about the past two months. Some time in December last a friend of his in another line of business asked him if he could help him to get nitre gas in some other form than using sulphuric acid. On his (Mr. Finn's) advice this gentleman substituted nitre cake for sulphuric acid; and at his place it was working quite satisfactorily, while his competitors in the same line of business were still declaring that it was impossible to use nitre cake. Naturally, in making sulphate of ammonia, his own method had been to make a bath up to 60° or 64° Twaddel. They found now that if they added 28 lbs. of nitre cake per bath immediately they finished blowing salt, they brought the liquor to about 74° Twaddel—10° higher than before. It brought the percentage of free acid to about the same, and made a salt containing about 24·6 per cent. of ammonia. The amount of free acid named in the Ministry of Munitions circular must, he thought, have been a mistake. The amount in his own was 0·19 per cent. of free acid. With regard to moisture, he would like to get it down; but he had never succeeded in getting below a little under 3 per cent. He would welcome any information as to how it was that this sulphate of ammonia had 3 per cent. of moisture in it. It appeared to be quite dry, and it would look as though the moisture was in the way of crystallization somewhere. He had not tried to make sulphate of ammonia with a lower percentage, because he had not been able to find any buyers. The Ministry of Munitions said no doubt it would be possible to find buyers; but he thought it was the business of the Ministry of Munitions to help producers to find people who would buy sulphate containing less than 24½ per cent. of ammonia.

Mr. G. W. Bradley said he would like to mention one interesting point theoretically on the pitch burning question. On a theoretical basis, it would seem impossible that they could obtain any valuable hydrocarbons by using pitch; so that by diluting the coal with the pitch, they were displacing the coal from the ovens. In regard to sulphate of ammonia, there was a very small percentage in the sulphate; and it should surely have a beneficial effect rather than otherwise. And certainly they could expect the arsenic in the sulphate to help in the present agricultural needs. In regard to nitro-sulphate in the nitre cake, agricultural people had told him that the land would not stand much salt; so it would seem that it would not stand much sulphate.

Mr. Cooper was afraid he was not sufficiently well versed in agriculture to be able to express an opinion on this point. He certainly thought that the arsenic question would not go very far. What they wanted to go back to was the idea of State research. The Government were dinning these things into them; and if they took the opportunity of putting some definite argument before people, they might do some good. The Government had a Department of Agriculture, and it was for this department to take some action and find out what was wanted. But, as Mr. Finn had said, and he himself had emphasized, the Government were beginning at the wrong end. If they would find some customers, the producers could make the sulphate of ammonia. The most important point in regard to use of nitre cake was what proportion of sulphuric acid to put in. If it was a few pounds of nitre cake in such a quantity that they only produced their ammonia salt—on a dry basis, he assumed—with 3 per cent. of moisture, to yield 24·6 per cent., he did not think it was worth tackling.

Mr. C. H. Oxley, touching on the remarks of Mr. Finn in regard to moisture in sulphate, said he had very little experience of the semi-direct process; but he found on the wet system the sulphate produced contained about 3½ per cent. of moisture. He did not know if it was common with the semi-direct or not; but try as he would, he did not seem able to get it below 3½ per cent., and he had to dry it artificially.

Mr. Cooper said the question of moisture he was rather at a loss to understand, because he had never had any trouble in this connection. He had had the artificial drying; but he had had no trouble, with the salt once dried, in picking up moisture. He believed if their acid rose above 0·5 or 0·6 per cent., they would have some trouble.

Mr. Myers said the question of moisture had bothered him at one time. His sulphate was not tested periodically, as ought to be done. They got parcels of sulphate going away with something like 3½ or 4 per cent. of moisture in it. He simply found that the sulphate men were not whizzing it properly. They had a lot of work on hand; and it was a case of the men scamping their work. By simply whizzing the salt properly, they now never got above about 2 per cent. of moisture.

Mr. W. B. Wilson Haigh said the only trouble he had had in regard to moisture was the blowing in of waste or exhaust steam from other sources.

Mr. G. A. Lant said in the Government circular they spoke of utilizing the nitre cake. It said, "Use two parts of nitrate water to three parts of chamber acid." This was all right for those who happened to be near an acid works; but how were the others to get the acid into the works? It would eat through iron tanks. The chamber acid also was full of arsenic. If they were going to use nitre cake and arsenical chamber acid, it was going to be a pretty funny sulphate of ammonia when everything was finished. In regard to the paragraph in the paper "Other Methods of Dealing with Ammonia," he should like to know what Mr. Cooper considered the most profitable to work to recover—the 15 per cent. or the 25 per cent. solution?

Mr. Cooper said the Government would pay them more for 25 per cent. solution than for 15 per cent.; but when they had made 25 per cent. for about five minutes, they would be glad to go back to the 15 per cent. With the 25 per cent., they very soon got the whole of the apparatus blocked-up solid. He found that, with his liquor, almost the instant they got about 17 per cent., they did not know where they were for five minutes together. The usual custom with regard to payment was by a sliding-scale, taking the basis of 15 per cent. The blockage he mentioned sometimes necessitated a fairly long stoppage; and these stoppcges had a habit of happening just when the storage tank was full. Thus, though they might have provision in the way of duplicate apparatus, he had sometimes had to shut-down the whole plant. From the point of view of the man who had to work the salt, there was not much doubt as to which was the best to work. To return to the question of strength of liquor, 15 per cent. was a good figure at his own plant, for the reason that they had at present only one storage tank. They had been experiencing very cold weather lately, and had been having requests for stronger liquor, and he found that the whole of his storage tank, at 17 per cent. strength, was absolutely solid, with the prevailing atmospheric temperature.

Mr. Haigh said that whenever he got an extra amount of arsenic in his acid—which, fortunately, was not often—the men began to complain. It made them ill. He did not know whether anybody had ever tried to treat the acid by passing the saturator gases through the acid in some way, outside the saturator. He had had no experience, but had been hoping to have heard something in regard to this—either lead-lined tanks or otherwise. With regard to the pitch problem, he thought they were perhaps making a great deal about the coke output. After all, the Ministry of Munitions wanted coke as well as other things; and he (Mr. Haigh) thought that they were not working at full speed on many plants simply because they were not getting enough coal.

Mr. Cooper considered it quite a practical suggestion that he had put forward in the paper. He had done it outside the saturator by making use of the mother liquor plant and running the acid down to 144° Twaddel into the liquor tank. Regard it, if they liked, as an extra acid tank; but it must be lead-lined. It was away from the saturator, and he brought in other crude gases, diluted, if necessary, with distilled gases, straight into the tank.

The President was entirely in agreement with Mr. Cooper in his statement that the Government should consult practical men. He had to say that in this connection the Council of the Association had already protested in very strong terms against some of the advisers who had been sent to the industry. The question of the use of nitre cake to him was not a very feasible one—for this reason: Some of them might consider that he was biased, because he had a sulphuric acid plant under his charge. But if they considered how much nitre cake would be necessary in the production of sulphate of ammonia in the amounts the Government required—assuming the three parts of chamber acid to the representative two parts of B.O.V.—it meant that they would want nearly 10 cwt. of acid qualities in the nitre cake. Compare this with what the sulphuric acid could do. He thought that, notwithstanding the large stocks of nitre cake up and down the country, inside a month the whole stock would be wiped out. As a fact, 100 tons of sulphate would produce less than a ton of nitre cake, which only showed how impracticable were some of the schemes put forth. With regard to the arsenical sulphuric acid, again perhaps he was a bit biased. There was not, in his opinion, a great deal of chance of their getting much non-arsenical acid. The ores from which it was made came from Norway and Sweden; and, apart from international difficulties, there was now a big strike on there. The majority of the ores coming here now were from Spain; and these were highly arsenical. The chamber acid was not so arsenical as the ordinary B.O.V. they bought. If they could get chamber acid at 110° Twaddel, it was fairly free from arsenic; but it was the acid the Government were wanting to-day. It was he considered within the means of any member to have a little dearsenicator plant of his own if he wished. It was simple; but the trouble was filtering afterwards. The means for dearsenicating were quite simple. With regard to the using of pitch, there was a suggestion from one of their own associate members (Mr. Taylor) that they could experiment with non-coking coal—adding pitch to it; and he (the President) hoped in the course of a few weeks to carry out some experiments in this direction and have something to report to the Association later.

Mr. Finn: Do I understand you to say you base the amount of nitre cake available in this country on the amount of sulphuric acid produced?

The President: Yes, practically.

Mr. Finn said this was not quite correct, of course, though he admitted that the bulk of the nitre cake was produced in the sulphuric acid plant. It was, however, also produced in the nitric acid plant.

The President: That is quite true. His statement, of course, should be corrected to this extent; but they knew that the quantity of nitric acid made was almost negligible as compared with the sulphuric acid.

Mr. J. T. Price (Hon. Secretary), referring to the President's remarks as to dearsenating acid, said he himself had carried out some small experiments. He had had various sorts of acid, and he had, as a result, put down a small experimental dearsenicating plant. He had not used the H_2S mentioned by Mr. Chrisp. He was sure the suggestion of putting down a small dearsenicating plant was quite a feasible one.

Mr. J. W. Lee moved a hearty vote of thanks to Mr. Cooper, and said as they were now in the special war stress they were doubly indebted to a man who spent a few moments of his leisure in giving the members the benefit of his experience.

Mr. E. M. Myers, seconding the vote of thanks, said personally he thought it was a most valuable paper which Mr. Cooper had given; and if they secured papers of this calibre throughout their existence, they would have amply justified the formation of the Association.

The proposition was carried unanimously, with acclamation.

Mr. Cooper, in a brief reply, said he had intended to put before them one or two amplifications of experimental work which he had in hand in connection with the subjects to which reference had been made—especially the use of nitre cake.

The Formation of Local Branches.

The meeting then proceeded to consider a motion, of which notice had been given previously by Mr. E. M. Myers, on behalf of the North Staffordshire members, as follows: "That sections be formed in different areas of the country, the formation of such sections to be sanctioned by the Association, and each section to have one representative on the Council of the Central Association. Such increase in the numbers of the Council, caused by the election of district representatives, shall be sanctioned *ad lib.*, until the whole of the areas of the country have been apportioned to respective branches."

Mr. Myers said he had put the arguments in favour of this proposal pretty fully at a previous meeting. He had hoped to have had Mr. Hollingworth, of Birchinwood, to second the motion; but that gentleman was unavoidably absent. The Staffordshire members had been asked to formulate a scheme; and at a meeting which they had had, it had been agreed that it would be far better for the formation of any scheme to be left in the hands of the Council of the Association, if the Association decided to have these branches. They in North Staffordshire, as he had mentioned at a previous meeting, had from time to time met among themselves to discuss problems of the industry—technical, commercial, and labour—long before the Association was formed; and when the Association was formed, the Staffordshire men had practically joined in a body. The men at a distance from the Sheffield centre, however, were under present conditions something in the nature of passive resisters. Fully half the members, he believed, were in the position of being unable, in the present stress of work, to get to any meetings or take any active part in the Association and its very important work. That was why the Staffordshire men had formulated this idea of area sections or branches. They were not prepared to determine the staking-out of the country; this would be better done by the Council. Even if it was rather early in the history of the Association to make such a change, he thought all would agree that it would be beneficial to the Association and to the industry; and it was highly important, of course, that the proposed branches should have direct representatives on the Council of the Central Association. The people in Staffordshire, Durham, and Cumberland, and in Wales, were at present paying their subscriptions more or less merely for the sake of patriotism to the industry; but at the same time the Association would be much healthier if workers were absorbed from all parts of the coke world in this country. Therefore he hoped the meeting would give the Association the power to establish these branches. He did not necessarily say that the whole of the country should be apportioned out immediately, with the power to add their representatives to the Council. All honour was due to those who had, in the Sheffield district, floated the Association into being, and worked it up; and there was no desire to prevent them from continuing the work of furthering the Association and the industry. All the outside men wanted was to be able to help.

The Hon. Secretary (Mr. J. T. Price) seconded the proposition. He said he had done a certain amount of work in the formation of the Association, and had come in contact with many of the members. Going through the list, he found that they had 89 members—including honorary members and associates. Durham and Cumberland contributed 14; Staffordshire, 10; South Wales, 5. The remainder were in the Yorkshire areas or on the borders; but some of these in Yorkshire in these busy times were at distances which prevented their attendance at Sheffield meetings. It was high time something was done for these members in the outside areas. As a matter of fact, a number of the members in Durham and Cumberland and in South Wales had drawn his attention to this need; and he had had several letters to this effect. He really believed that the matter must be tackled very shortly, or they might be losing some of the members living long distances away. He thought the branches could be formed at once. The Council, he believed, were unanimous on the point. He thought that they should consider the formation of the Association somewhat on the lines of the Institution of Gas Engineers—governed by a Central Executive, on which would be representatives of the branches. It was all right these distant men having the honour of belonging to the Association; but they wanted, and were entitled to, something more for their money than the advance copies of the papers, which could be read in the Technical Press without being members. He believed, indeed, the existing system of the Association was keeping out some men who would otherwise be members.

The CHAIRMAN read a telegram from Mr. Hollingworth, regretting his unavoidable absence, and hoping the meeting would adopt the formation of branches. The President said he was cordially in agreement with the proposal, and he believed the Council were also. The original idea when the Association was started, had been to form a Sheffield Association; but it had developed so rapidly that it had become a national thing. Branches ought certainly to be formed and representatives sent to the Council.

Mr. HAIGH said he took it that the resolution would not alter the existing rules.

Mr. MYERS replied that part of the original motion had been left out deliberately, so that the rules need not be altered.

The PRESIDENT said under the proposed scheme the Council would consist naturally of more than five members.

Mr. J. W. LEE said he was entirely in agreement with the idea; but he asked if it would not be better for the Association to have a definite scheme before it, before voting on the matter. He was convinced that such a system was the eventual outcome for the Association; but it would be better for the Council to have consultation with special representatives of the areas before submitting a scheme for final acceptance by the members. They had as yet no idea how large or how small the areas were to be. He might say, in answer to the reference to the Institution of Gas Engineers, that this organization had no branches. It was one association, and meetings were held in different parts of the country wherever the President for the year happened to live and work. Actually what happened was that there were District and Junior Associations.

The PRESIDENT said the Council had already several schemes under consideration; and if the meeting passed the resolution authorizing the Association to proceed with the idea, the Council would probably present a scheme at the next general meeting.

Mr. PRICE said he had not meant that they should copy exactly the Institution of Gas Engineers. He simply meant that they should base their idea on the Central Association lines of the Institution, and have the annual meetings of the Association at different centres on their lines. He had communicated with Durham and Cumberland and South Wales, in regard to their sending a representative to consult with the Council; but all the gentlemen who had written suggested that a circular direct from headquarters would meet with better success than any action taken by them individually in their areas.

Mr. HAIGH said if all they were asked to do that evening was to sanction the principle of the formation of branches, he thought they were all in agreement. He was quite with Mr. Lee in regard to excepting details as yet.

Mr. MYERS said the only detail the motion possessed was that of the appointment of representatives on the Council. Without this detail the idea was worthless.

The motion was then put and carried unanimously.

HAVE VERTICAL RETORTS MADE GOOD?

From an American Point of View.

The "American Gaslight Journal" for Feb. 14 contains an article on this subject, by Mr. R. N. Buell, some parts of which will interest English readers.

He wrote: To the gas company contemplating the construction of new, or the enlarging of its present coal-gas plant, no greater problem presents itself than the question as to the type of bench to be installed—Shall it be "horizontals," "inclines," or "verticals?" The author will not be so presumptuous as to offer an opinion as to which system is best; but by placing before readers comparative data, gleaned from reliable sources, the present status of the various styles of coal-gas benches may be more readily understood.

Beginning from the time of Murdoch with cast-iron retorts set in horizontal benches, with very shallow furnaces, the construction of coal-gas benches, for a period of fifty years or more, underwent little change; the improvements being very gradual and limited. The principal innovations during this time were the adoption of fire-clay retorts of various shapes, in place of cast-iron ones; and the introduction of the regenerative or recuperative furnace, by means of which a larger firebox capacity was available, and the use of properly-heated secondary air mixed with the producer gases in the combustion chamber, furnished a much higher degree of heat than was hitherto obtainable. A few other minor changes had also been made—such as the substitution of the lever self-sealing mouthpiece lid for the lime-luted screw lid, and the introduction of water, steam, and air under the furnace grate-bars to minimize the collection of clinker in the fire-box.

Trials had also been made, in a limited way, with benches of through retorts; and power charging and discharging machines had begun to appear upon the market. During the latter part of the Nineteenth Century various experiments were made with the inclined type of gas-bench, which was a distinct innovation, and caused the old conservative gas makers to make forecasts of its ultimate failure. They contended that the charge of coal would clog the retorts, making it impossible to withdraw the coke; that the temperature inside the retorts could not be properly controlled; and that the weight of the retorts would displace the lower outside wall. These calamities, however, failed to materialize; and the wise ones admitted that the inclines had come to stay. Many authorities claim that the inclined system to-day, with the many improvements recently added, is the best type of bench for plants making from one to two millions per day.

While the horizontal and inclined benches were contending for the honours of greatest efficiency, suddenly the vertical system loomed above the horizon and claimed a hearing. For the past few years verticals of continuous and of intermittent types have made great strides in popularity and efficiency. The plans and specifications of the systems have undergone many changes since their introduction, both in line and dimension, and silica retorts and settings, in place of fire-clay, are now the general usage.

In America, the adoption of the vertical system has been confined to the Eastern States and Canada. But the Western and Middle West States are studying the situation; and if ultimate results bear out the claims made by their promoters, the next few years may witness the installation of many new vertical plants.

Various problems enter into the selection of a system; but the question generally narrows itself down to one of economy. Which system can deliver marketable gas into the holders at the least cost? Of course, there may be various local conditions that influence the final decision. For instance, if ground area is limited, the vertical system has a distinct advantage.

To determine the relative operating conditions, and the results obtained by the three leading types of coal carbonizing plants using retorts, the writer has obtained authentic data from some of the largest and most successful gas-works in America. The statistics are from three well-known plants—*i.e.*, the Laclede Gaslight Company of St. Louis, using the horizontal-through system; the Springfield Gaslight Company of Springfield, Mass., using the inclined system; and the Ottawa Gas Company, Canada, using Glover-West verticals. No doubt the average gas man will find food for thought in the tabulated statistics. It may be taken as an accepted fact that the abnormal yield of gas per pound of coal carbonized obtained by the Ottawa plant could never be successfully maintained in the States, where the standard of B.Th.U. calls for much richer gas.

One pertinent inquiry that may arise in the minds of some who read this article is this: If gas of 535 B.Th.U. calorific value is satisfactory to Canadian consumers, why would not a gas of equal value pass muster in the United States? This and similar questions which the discussion of the subject may have suggested, the writer leaves to those more capable than is he to answer—believing that the army of experts giving serious thought to the advancement of the manufacture of artificial gas will eventually produce now undreamed-of issues, and sure to result in credit to the industry, and to the benefit of the public at large.

—	St. Louis.	Springfield.	Ottawa.
Type of bench	Horizontal	Inclined	Vertical
Date of installation	1913	1905	1915
Number of benches	16	5	6
Number of retorts per bench	8	9	8
Dimensions of retorts	16 inch by 26 inch by 16 feet	15 inch by 23 inch by 18 feet	8¼ in. by 2 ft. 9 in. Top 1 ft. 6½ in. by 3 ft. 3 in. Bottom 20 ft. 3⅞ in. Long
Coal capacity of retorts per foot	81 lbs.	60 lbs.	100 lbs.
Average gas yield per pound of coal carbonized	5·75 cubic feet	5·00 cubic feet	6·389 cubic feet *
Average fuel consumption, per cent.	13½ to 15	15	15
Candle power of gas	16·5	16	—
Calorific value, B.Th.U.	620	610	535
Duration of charge	8 hours	6 hours	Continuous—Coal passes through in 10 hours
Method of charging	De Brouwer machine	Gravity	Gravity
Composition of retorts	Silica	Fire-clay	Fire-clay †
Ammonia recovered per ton of coal carbonized	5·75 lbs.	5 lbs.	4·5 lbs.
Tar recovered per ton of coal carbonized	12 gallons	15 gallons	12 to 14 gallons
Cost of retort-house labour per ton of coal carbonized	27¾ cents ‡	—	—
Scurfing periods	14 days	6 weeks	18 days

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* The apparent high yield obtained in Ottawa may be accounted for by two things: First, the automatic coal-scales were found to vary 5 per cent.; and, second, in cooling the coke, a jet of live steam is passed into the coke-chambers, producing water gas, thus increasing the yield and decreasing the B.Th.U. of the gas.

† Combustion chambers lined with silica.

Does not include superintendence or exhauster attendance, but includes cost of handling coal from cars to bins, and coke to outside receiving bins.

PRODUCTION OF AMMONIA FROM CYANAMIDE.

The text is now available of a paper by Mr. W. S. Landis, of the American Cyanamide Company, presented at the eighth annual meeting of the American Institute of Chemical Engineers, held at Baltimore on Jan. 12.

INTRODUCTION.

After working for many years on the problem of the fixation of atmospheric nitrogen in the form of cyanides and cyanamides, the outbreak of the Boer War forced Professors Frank and Caro, of Berlin, to turn their attention to the utilization of their products otherwise than in the field of precious metal extraction. A consequence of the then existing economic situation was the discovery of the process of transforming the cyanamide compounds into ammonia. United States Patent No. 776,314, granted Nov. 29, 1904, most probably represents the first American publication on this subject.

According to the specifications of this patent, various cyanamide compounds and derivatives—including the crude form of the calcium salt, sold under the name of lime nitrogen—when treated with steam or water in the proportion of three molecules of water to two atoms of the nitrogen in the cyanamide salt, will yield ammonia. It is recommended in the specification that the reaction be carried out at temperatures from 160° to 180° C., in a closed vessel, though the claims of this patent cover temperatures above 100° C.

There has grown around this process and its later refinements in the last fifteen years an extremely important ammonia industry. Naturally, the greatest development has been in Europe, its home; and it is only within the past year that a plant comprising full-sized apparatus has been in operation in the United States. In attempting to catalogue the various plants throughout the world which have been converting cyanamide into ammonia in large-scale operations, I find that available information—particularly since the outbreak of the European War—is so incomplete that the listing in consequence was very inaccurate. It is certain, however, that the transformation of cyanamide into ammonia is successfully carried out in Norway, Germany, France, Switzerland, Italy, and Japan, and, prior to the war, in Belgium—the bulk of the product going into ammonium sulphate for the chemical and fertilizer trade. Norway is producing large quantities of ammonia used in the Birkeland-Eyde plants for the production of ammonium nitrate; France has produced considerable quantities of anhydrous ammonia by this process; at the present time Germany is producing enormous quantities of nitric acid from this cyanamide-ammonia by a newly developed oxidation process, and is erecting cyanamide plants fully equipped with ammonia apparatus at various places.

The fixation of atmospheric nitrogen—chiefly due to our Government's policy in respect to water-power development—has not been practised in the United States. During the year 1914 contracts were let in Germany by the American Cyanamide Company for the equipment of the largest single ammonia plant then projected or operating in the cyanamide industry; but the outbreak of the European War interfered with the shipment of the apparatus, nearly all of which was seized by the German Government for the purpose of providing for its own explosive requirements. It was possible to bring only a small portion of the equipment over to the States, where it was set up and put into operation, and is now producing several tons of pure ammonia gas per day. This plant has been in continuous operation here for six months without any signs of trouble whatever, and is considered to be most successful and satisfactory in every way.

RAW MATERIALS.

The crude cyanamide or lime nitrogen is now a well-known commercial product. The Canadian factory supplying the United States and its insular possessions with this product has a capacity of fixing nitrogen equivalent to 90,000 lbs. of ammonia per day, and with the completion of certain additions now being made will be capable of supplying some 110,000 lbs. of ammonia each twenty-four hours. The demands for this product (most of which goes into the fertilizer industry) are so great that the plant is now operating at its full rated capacity. It is, therefore, evident that the supply of raw material for an ammonia industry is in no sense limited.

Crude cyanamide or lime nitrogen, the reagent used for the production of ammonia, is an electric furnace product. As turned out of the furnace it contains nearly 25 per cent. of nitrogen in the form of $CaCN_2$, 12 per cent. of CaO, and 12 per cent. of carbon, with miscellaneous impurities derived from the various raw materials entering into its manufacture.

The other raw materials entering into the ammonia process are soda ash and hydrated lime. The quantities used are small—being approximately 3·5 and 2 per cent. respectively of the weight of lime nitrogen used. Steam and power requirements, which vary with the size of the plant, are discussed later.

CHEMISTRY.

On treating lime nitrogen with steam, ammonia is produced from the calcium cyanamide, according to the reaction:

$$CaCN_2 + 3H_2O = CaCO_3 + 2NH_3.$$

The reaction is almost quantitative when carried out on a large scale according to the process to be described later in detail. This reaction is exothermic in character; and while the exact heat of formation of calcium cyanamide has never been determined accurately, it is believed that the heat evolution from the decomposition of the cyanamide alone amounts to between 200 lbs. and 300 lbs. cals. per pound of ammonia evolved. This plays an important part in the present method of carrying out the process, inasmuch as after once starting the reaction under proper conditions it will proceed of itself—in fact, with such great velocity that only complicated and highly-developed apparatus can take care of the gaseous products.

The process as carried out in the plant operating in the United States is essentially that described in the specifications of United States Patent No. 1,149,633, dated Aug. 10, 1915, "Process of Making Ammonia from Calcium Cyanamide."

In order to take advantage of the exothermic character of the reaction, as above stated, the process is made to take place in an autoclave partly under high pressure. This apparatus consists of a steel tank approximately 6 feet in diameter, 21 feet high, and capable of operating under a working pressure of 300 lbs. per square inch. It is provided with a powerful stirring apparatus. Into the autoclave is charged about 12,000 lbs. of mother liquor derived from a previous operation (fresh water to start); and lime nitrogen is slowly fed into this liquor under continuous agitation. As the lime nitrogen contains always a fraction of 1 per cent. of undecomposed carbide, acetylene is evolved during this dissolving of the lime nitrogen. A proper ventilating system is provided to remove the acetylene at such dilutions as will be non-explosive even if subjected to a source of ignition. The charging is usually carried on over a period of an hour, so as to ensure thorough incorporation of the lime nitrogen with the solution and the breaking-up of all lumps in the slurry. When the lime nitrogen has all been added to the autoclave, the reagents (soda and lime) are added for the purpose of increasing the efficiency of the ammonia evolution, principally through the prevention of the formation of polymeric forms of cyanamide compounds, which are difficult of transformation into ammonia.

The autoclave is then closed and steam is admitted for approximately 15 minutes, or until the pressure gauge on the autoclave registers 3 or 4 atmospheres, which indicates that the temperature in the autoclave has been raised sufficiently to start the reaction at a fair rate of speed. The reation then proceeds of itself—generating ammonia and steam in the autoclave; and it is necessary to relieve this gas accumulation, by means of suitable valves, so as to avoid excessive pressures in the apparatus. The rate of reaction becomes cumulative as the temperature rises; and this relief of ammonia and steam must be permitted. Under normal working conditions the pressure in the autoclave will rise to about 12 to 15 atmospheres in the course of about twenty minutes, with the relief-valve open. The pressure then drops off slowly, as the gas is discharged; the rate of discharge being usually regulated by the attendant at the valve so as to maintain a constant pressure in the ammonia line, and at the end of about one-and-a-half hours from the start of the operation the evolution has usually stopped.

Nearly all the cyanamide in the charge has been decomposed during the first period of this operation; but the solution is still highly charged with ammonia, which it is necessary to expel. A very small amount of undecomposed lime nitrogen may be left—particularly of polymerized forms, which yield up ammonia only slowly. The steaming operation is then repeated, this time introducing steam until the pressure of the autoclave goes up to 6 to 8 atmospheres. The ammonia discharge valves are again opened until the autoclave is discharged, requiring a period averaging approximately half-an-hour for this second discharge. In order to ensure practically complete evolution of all the ammonia in the autoclave, it is advisable to again repeat the steaming to 6 to 8 atmospheres for a third period—discharging as before. During this last period of steaming and discharge rarely more than 2 per cent. of the total ammonia as charged is evolved; and it can, therefore, be omitted if extraordinary demands on the capacity of the apparatus are made.

Extended studies of the course of this decomposition of lime nitrogen in the autoclave have been made both abroad and in this country, and are here reproduced in the form of charts. The discharge from the autoclave consists of a mixture of steam and

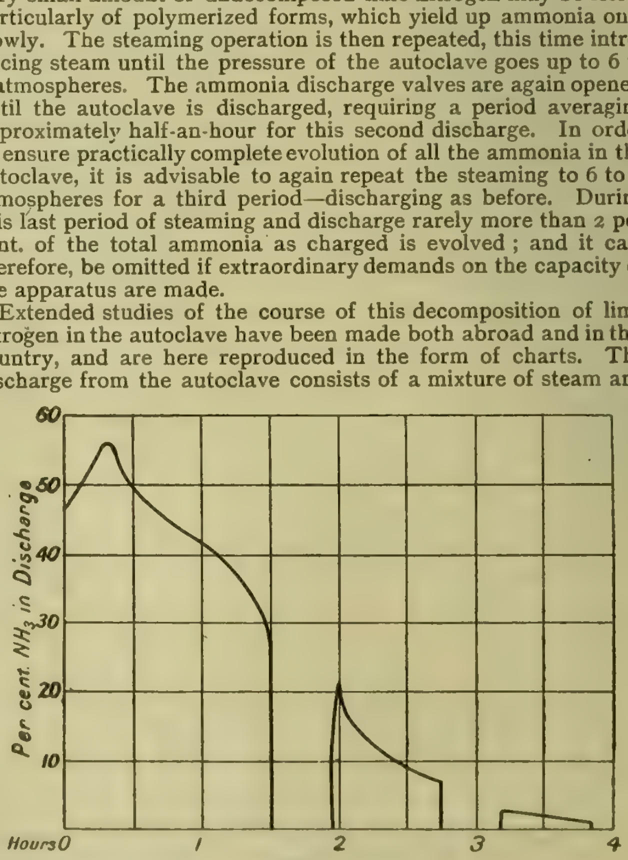


Fig. 1.

ammonia, the composition gradually changing during the cycle. This variation in composition is shown for an actual operation carried out in this country in fig. 1, in which the ordinates represent the percentage of NH_3 by weight in the ammonia-steam mixture discharged from the autoclaves, and the abscissa the time after start of the operation—analyses of the discharge being made at approximately three-minute intervals.

The rate at which ammonia is discharged from the autoclave under operating conditions varies with the imposed condition. It has been found that most requirements are met by discharging at such rate as to maintain a constant pressure of steam and ammonia in the main leading from the autoclave. Under such conditions the rates of discharge during a given operating cycle are represented by the curve in fig. 2, in which the ordinates are the pounds of ammonia discharged per hour, and the abscissa again the various elapsed times from the start. In this case the charge in the autoclave was 7000 lbs. of lime nitrogen analyzing about 26 per cent. equivalent NH_3.

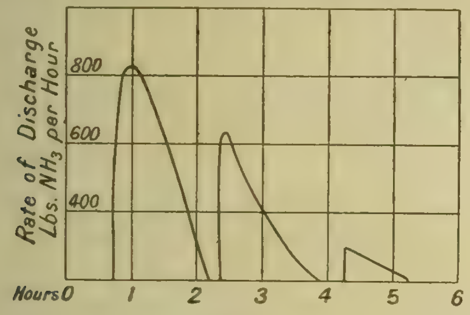


Fig. 2.

Where a uniform supply of ammonia is required, it can be obtained by the insertion of a special type of gasholder in the system. Also suitable grouping of a number of autoclaves and their cylindrical operation will assist greatly in obtaining a uniform rate of production without the use of such gasholder.

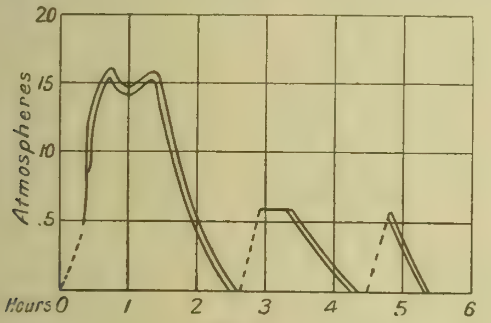


Fig. 3.

In fig. 3 is shown a curve of the pressures existing in a European autoclave, slightly smaller than the one described above, and operating on a charge of 8000 lbs. of lime nitrogen. The dotted lines represent the admission of steam, and the full lines the pressures as shown on the gauge on the autoclave. The ammonia discharge valves of the autoclaves are opened where the lines are indicated double.

At the close of the operation, the bottom discharge valve is opened, and the mud contained therein runs by gravity into large suction filters of the "Nutsche" type. Here the liquor is sucked-off from the solid constituents; a thorough wash with water is given; and the sludge removed to the dump. Under normal operating conditions this sludge when dried contains less than 0·2 per cent. of equivalent ammonia, and about 65 per cent. of CaO in the forms of carbonate and hydrate. It is dark grey or black in colour, due to the carbon present, and finds application as an agricultural lime. The liquor removed from the filter is used in dissolving the next batch.

HANDLING THE GAS.

In the manufacture of ammonium sulphate, as carried out extensively abroad, the mixture of steam and ammonia coming from the autoclave is led directly into an absorber and produces a high-grade white sulphate. This production of sulphate is much simpler than from ammonia liquor. Where the introduction of the accompanying steam is not permissible—as in the production of certain ammonia salts which cannot be subjected to high temperatures, or where the process involves subsequent evaporation and crystallization—the ammonia-steam mixture coming from the autoclave is passed through a simple rectifying column provided with a dephlegmator and condenser, and there is obtained therefrom a practically chemically pure ammonia gas, saturated with moisture at the temperature of the condensing water. This rectifying column is self-acting, because of the large quantity of steam admitted with the ammonia-steam mixture. It requires no attention whatever in its operation, other than to shut off the cooling water to the condenser when not in use.

The ammonia derived from the column, as before mentioned, is practically chemically pure, and is used directly in a large number of chemical industries. The Birkeland-Eyde engineers absorb this ammonia gas in distilled water, forming a dilute aqua ammonia, which they add directly to their dilute nitric acid for the manufacture of ammonium nitrate—the product being of extraordinary quality. On the other hand, ammonium nitrate of equal grade may be produced directly from the ammonia gases dehydrated in the column without the water absorption step.

One of the large autoclave plants in France has been manufacturing anhydrous ammonia for years; and in addition to the above purification system they have installed an oil-washer, charcoal filter, and lime drying boxes before liquefaction. The oil-washer, the writer was informed, was installed to remove some very minute traces of an unknown organic compound; but he has inferred that the character and quantity of this impurity, from the manipulation of the apparatus, is largely mythical.

For the production of nitric acid from ammonia, the product as taken from the condensers attached to the ammonia column is so pure that no trouble is occasioned by the poisoning of the catalyzers used in its subsequent oxidation.

EFFICIENCY OF DECOMPOSITION.

An extended study made by the writer a year ago of one of the European plants which had been in operation for a long time, showed that the transformation efficiency of the nitrogen in the lime nitrogen into ammonia was over 99 per cent. Our American plant is showing operating efficiencies, covering a period of several months, substantially equal to the above.

AUTOCLAVE PLANT.

An economical autoclave unit is one of eight working shells. As the operating load factor on these autoclaves is very close to 100 per cent., it is not necessary to supply more than one spare shell to this eight-autoclave equipment to ensure a full 100 per cent. load factor. Such a plant of eight autoclaves would require a 300 H.P. boiler. It was the old practice abroad to set the safety valve on the autoclave shells at twenty atmospheres and operate the boiler at this pressure. In our own designs here in the States, we have successfully operated at 125 lbs. steam pressure without trouble, and can take steam from a common plant main. Superheated steam is preferable for the purpose, but not absolutely necessary. There are in addition required for operating the lime nitrogen feeding device, the stirrers in the autoclaves, the vacuum pump and the air compressor, and miscellaneous sludge disposal equipment, a continuous motor load of approximately 100 H.P. (the connected motor load would probably average about 200 H.P., depending upon local conditions).

OPERATING COSTS.

In the compilation of a cost-sheet for the production of ammonia from lime nitrogen, there is such great latitude in unit costs concerned that the writer is presenting rather full quantitative data, to which he is appending assumed unit costs. In most cases the assumed unit costs are averages existing before the outbreak of the European War; but to these an approximate return may be expected after its close. In any case they may be readily corrected to meet local conditions.

Lime nitrogen (26 *per cent. ammonia*) is unquestionably the cheapest source of nitrogen (ammonia) in this country. The sale prices are dependent to an extent upon the quantities and deliveries contracted for. The freight is allowed at $3 per ton of lime nitrogen shipped in special containers, which should cover the greater portion of territory in the United States lying within a 500-mile haulage radius of Niagara.

Caustic lime is to be air-slaked on spot, 2 per cent. weight of lime nitrogen assumed at $6 per ton delivered.

Soda Ash. 3·5 per cent. of weight of lime nitrogen at $16 per ton delivered.

Power. 100 H.P. continuous at 1 c. per H.P. hour.

Steam at 30 c. per 1000 lbs., 60 per cent. weight lime nitrogen.

Water. 2 U.S. gallons per lb. of ammonia. As the larger part of this is used in condensers and coolers, the greater proportion may be salt water. Assumed at 2 c. per 1000 gallons.

Labour and Superintendence. Assumed at 300 men-hours per day at 30 c. per man-hour.

Repairs and Renewals. $1·50 per ton of ammonia—a record of long time operations.

Interest. Assumed at 6 per cent. on plant cost of $120,000.

Depreciation. On plant cost of $120,000 depreciated in ten years—say, 8 per cent.

Operating Cost of Ammonia Plant.

Capacity, 30,000 lbs. of Ammonia per Day.

Gas Saturated with Water at Cooling Water Temperatures.

Item.	Quantity.	Rate.	Per Day.	Per Lb. Ammonia.
		Dols.	Dols.	Dols.
Freight	—	3·00	180·00	0·00600
Lime	1·20 tons	6·00	7·20	0·00024
Soda	2·10 ,,	16·00	33·60	0·00112
Power	2400 h.p. hr.	0·01	24·00	0·00080
Steam	72,000 lbs.	0·30	21·60	0·00072
Water	60,000 gallons	0·02	1·20	0·00004
Labour	300 men-hours	0·30	90·00	0·00300
Repairs and renewals	..	..	22·50	0·00075
Interest	..	..	20·00	0·00067
Depreciation	..	..	26·66	0·00089
Miscellaneous	..	..	24·67	0·00082
Total conversion cost (excluding NH_3 losses)			451·43	0·01505

COST OF PLANT.

On account of the varied building conditions existing through the country, it is almost impossible to give a detailed estimate of the cost of plant. A recent projection of such costs made by this Company for a plant of this size—from which I have deducted the cost of land, foundations, and sludge disposal—shows that an ammonia plant of the size described could be erected for about $120,000. This plant is designed to produce as its final product an ammonia gas cooled to the temperature of the available water of the condensers, and, therefore, not strictly anhydrous. This figure further assumes that water and power are furnished to the plant, and no provision is made for power or pumping plants.

Steel buildings with corrugated iron sides and roof, and of a type which have demonstrated themselves as fairly satisfactory for this service, are included. The limitations imposed by building laws, and choice of architecture, may force one to materially modify this estimate, as cheaper forms of construction may be used. On the other hand, many may prefer a more elaborate type of building than that provided in the above estimate, which would materially raise this figure.

SUMMARY.

The large number of installations operating with perfect success in various parts of the world for a number of years have demonstrated the commercial possibility of making ammonia from lime nitrogen. The plant in its present highly developed state is extremely certain in its action and simple to operate. The efficiency obtained in the transformation of the nitrogen in lime nitrogen into ammonia gas is upwards of 98 per cent., or almost quantitative. The consumption of reagents is remarkably small; and they are cheap and easy to obtain in almost all parts of the world.

The quality of the ammonia produced by the process is not surpassed by any in the United States. It is chemically pure as produced, and requires no further costly and tedious purification to render it available for the highest-grade chemical products, or for the production of liquefied anhydrous product. The actual cost of production of this high-grade pure ammonia on a considerable scale, which enables one to take advantage of the lower prices at which lime nitrogen is offered, brings high-grade cyanamide-ammonia into the market almost as cheaply as the more impure forms already found there, and very much cheaper than it is possible to obtain an equal quality of ammonia from gas-house liquor, coke-ovens, &c.

The Fuel Question at the End of the War.

Dr. P. W. Uhlmann, now resident at San Paulo, has communicated, in a long article in the "Chemiker Zeitung," his views on the way in which the fuel question will be taken up after the war is over. In their own interests, all large consumers of coal will, he thinks, make the change to gas-making with recovery of bye-products. Large central stations will be established for the production of gas and electricity, at the pit's-mouth in the case of coal, and close to lignite and peat deposits. The State will insist on the economical use of fuel, and encourage manufacturers to adopt plant for consuming it on rational lines. Maximum charges will be fixed for gas and electricity, and spheres of employment allotted to each—subject to one works being able to assist the other in case of any interruption of operation. The adoption of such a system will, according to Dr. Uhlmann, afford the following advantages: Economy of fuel, especially through a far more extended use of coke; recovery of bye-products; opening-up of peat-bogs, and consequent extension of agriculture; saving of labour in industry, and consequent liberation of labour for agriculture; cheapening of work in industry and agriculture; and improvement in the means of competition in the world's markets.

* * *

Road Board and Tar Treatment.—Supplementing the statement made in the "JOURNAL" for the 15th inst., that the Secretary of the Institution of Gas Engineers had received an official intimation that the Treasury had sanctioned a similar grant this year to the Road Board to that made last year, it may be mentioned that the Board have now informed county authorities that the Treasury have authorized them to make grants and loans of £200,000 for surface tarring, pitch grouting, and tar macadam. This, the Board add, is in view of the desire of the Ministry of Munitions to encourage the use of refined tar, so as to maintain the supply of distillation products for high explosives, and also to protect important roads from disintegration.

Advocating the Calorific Standard.—The Secretary of the National Commercial Gas Association of America has been instructed to ask all the State and District Associations to present to their members for approval a resolution which was passed at the Washington Convention of the Association, earnestly recommending the adoption of the heating basis in rating the value of gas. The reasons set forth in the resolution are the almost universal adoption of the incandescent system, the great and increasing demand for gas for industrial and domestic purposes other than illumination, and the fact that the leading authorities, after making exhaustive and impartial examinations, have concluded that the heating value is the proper basis of rating of gas quality, "which conclusion is emphasized by recent State Commission rules having specified that the rating of gas quality shall be based on the heating value of the gas."

THE CARBONIZATION OF PITCH.

Some Data by Mr. Tim Duxbury, of Oldham.

At Saturday's meeting of the Manchester District Institution of Gas Engineers, Mr. TIM DUXBURY (the Engineer of the Oldham Corporation Gas-Works) referred to the question of "Carbonization of Pitch," a subject which has aroused great interest in the profession. It had been intended that the proceedings should take the shape of an informal discussion upon the whole matter; but owing to the heavy programme gone through during the afternoon, there was little time for more than hurried reference to the subject.

Mr. DUXBURY, who was received with cordiality in recognition of the work he has done in investigating the question, gave the following statistics on coal and pitch mixtures, and hard pitch.

January, 1916.

EXPERIMENTAL PLANT CARBONIZING 24 CWT. OF COAL PER DAY.

COAL AND ORDINARY PITCH MIXTURES.

—	Coal Neat.	5 per Cent. Pitch.	10 per Cent. Pitch.
Coal carbonized . . . . cwt.	40	40	40
Pitch carbonized . . . . ,,	0	2	4
	—	—	—
Total . . . . ,,	40	42	44
Total gas made . . . . . cub. ft.	27,130	27,020	27,050
Gas made per ton of coal only, uncorrected . . . . cub. ft.	13,565	13,510	13,525
Gas made per ton of coal, corrected to 60° Fahr. . . . . cub. ft.	13,090	13,085	13,095
Calorific value of gas—gross B.Th.U. on calorgraph	581	594	625
Candle power, ½ hour bookings on jet .	16·20	16·73	17·38
Corrected gas made per ton of coal and cub. feet calculated to 540 B.Th.U. gross	14,090	14,400	15,170
Coke per ton of coal only . . . . lbs.	1,668	1,743	1,808
Tar per ton of coal only . . . . gallons	12·0	15·5	17·75
Quality of coke	Good	Good	Good
Quality of tar	—	—	—

Coal used, Hemsworth washed nuts, all from the same waggon.

Heats higher when using pitch coke.

Make per ton calculated on coal only, not including pitch.

Ordinary pitch used, not specially hard pitch.

THE RESULTS OBTAINED.

Five per cent., or 1 cwt., of pitch per ton of coal carbonized gave an increased yield of 310 cubic feet of gas per ton of coal, 75 lbs. of coke, and 3½ gallons of tar. This is equivalent to 6200 cubic feet of gas, 1500 lbs. of coke, and 70 gallons of tar per ton of pitch. Taking gas at 10d. per 1000 cubic feet, coke at 15s. per ton, and tar at 20s. per ton, the figures give a value of 22s. 2d. per ton of pitch. The calorific value of the gas was increased from 581 B.Th.U. to 594 B.Th.U., and the candle power from 16·20 to 16·73. The coke was improved; the heats being higher after using pitch each test. Similar comparative results were obtained by carbonizing 10 per cent. of pitch. The above yield per ton was calculated on coal only, not coal *plus* pitch. The tar analysis is not yet completed; but the specific gravity was slightly higher. The tar also contains more naphthalene.

COAL AND HARD PITCH MIXTURES ON EXPERIMENTAL PLANT.

—	Coal Neat.	Coal *Plus* 5 per Cent Pitch.	Coal *Plus* 10 per Cent. Pitch.
Coal carbonized . . . . cwt.	20	20	20
Hard pitch carbonized . . . . . ,,	0	1	2
	—	—	—
Total . . . . ,,	20	21	22
Total gas made . . . . . . cub. ft.	14,490	14,810	14,950
Gas made per ton of coal only, uncorrected . . . . cub. ft.	14,490	14,810	14,950
Gas made per ton of coal, corrected to 60° Fahr. . . . . cub. ft.	14,120	14,240	14,710
Calorific value of gas gross—B.Th.U. on calorgraph	531	552	551
Candle power on jet taken every ½ hour .	14·96	15·23	15·83
Corrected gas made per ton of coal and calculated to 540 B.Th.U. . . . gross	13,880	14,556	15,010
Coke per ton of coal . . . . . . lbs.	1,657	1,717	1,780
Tar per ton of coal . . . . . gallons	11½	15½	17
Quality of coke	Good	Good	Good

Coal used, Hemsworth washed nuts, all from same waggon for these three tests.

Heats higher when using pitch.

Make per ton calculated on coal only, not including pitch.

Oldham Corporation Gas-Works Laboratory Report.

Feb. 16, 1916.

Examination of Tar from Coal Treated with 10 *Per Cent. of Hard Pitch and from Untreated Coal.*

Coal used, Hemsworth washed nuts, both samples from one and the same waggon.

Tested 1 ton of coal in each case on experimental plant.

Took 2000 c.c. of tar, and distilled up to 300° C.

—	Untreated.	Treated.	Remarks.
Gas made corrected to 540 B.Th.U. . . . cub. ft.	13,880	15,020	..
Tar made . . . gallons	11½	17	..
Water content in tar, per cent.	4·3	3·6	..
Naphthalene, &c., ditto. .	13·25	17·5	By volume
Toluol per ton of tar, gallons	2·460	2·040	Corrected for paraffins and to 5 per cent. water content
Toluol per ton of coal, gallons	0·141	0·173	Corrected for paraffins and to 5 per cent. water content
Pitch by weight, per cent. .	69·62 Hard and dull	71·80 Softer and Brighter	..

One little difficulty they experienced in stacking pitch was that they could not carry it to any great height. At first, they decided to stack it 10 or 15 feet high; and they left a 2 feet passage down each side of the wall and in the centre. But in less than a month all the pitch came together—so much so that it was nearly pushing the wall of the building into the adjoining canal. This necessitated cutting a road on the canal side. He merely mentioned it as one of the troubles in dealing with the question. Briefly, the proposal was to carbonize pitch, and to take it off the market to a large extent; and it was his experience that the more coal they carbonized admixed with pitch, the more toluol they recovered. The increase at Oldham in toluol recovery by this treatment was 0·032 gallon for every 2 cwt. of pitch; and he was of opinion that whatever increase of toluol they got came from the pitch alone.

Mr. Samuel Glover (St. Helens) said the suggestion of the carbonization of a percentage of pitch in gas-works was a way by which the tar maker could control to some extent the value he shall ultimately receive for his tar, inasmuch as if he helped to remove to some degree the incubus of the increasing stock of pitch held by tar distillers in this country, he was in a measure avoiding the still further drop in the prices of tar which would surely come about if pitch could not be removed into a new market for the time being. Let each engineer find out what percentage he could use—from 2½ to 5 per cent.—of the pitch he could get delivered at his works, either from his own tar distiller or from some other source. A comparison of prices between coal at the present day, and pitch at the price to which it had descended, made this proposal quite a practical one.

Mr. H. Kendrick (Stretford) congratulated Mr. Duxbury on his excellent figures, and said he had been greatly interested in those published in the "Journal of Gas Lighting" from Mr. Thomas Glover, of Norwich, and also those of Mr. Alex. Yuill, of Dundee. He desired to emphasize the importance of the statements made in the "Journal of Gas Lighting" for Feb. 22 [*ante*, p. 402], with which he cordially agreed. The most promising outlook for restricting the accumulation of pitch was to use it admixed with coal for gas making; for at the present prices it would undoubtedly pay to carbonize pitch, as the latter commodity could be delivered at less than coal prices. As yet, however, the profitableness did not appear to be very substantial. The greatest advantage seemed to lie in preventing the pitch market being laid in ruins for a considerable time. The following figures showed results achieved at Stretford for the seven weeks commencing Jan. 12 last; the quantity of pitch used being 142 tons, or 4·7 per cent. of the coal carbonized.

	With Pitch.		Without Pitch.
Gas made per ton (corrected), cubic feet .	12,292	..	12,393
Illuminating power.	14·59	..	15·10
Calorific value, gross B.Th.U.	511·6	..	523·0
Temperature average, Fahr.	40°	..	46°

[The figures showing the results without pitch are those taken for the seven weeks immediately preceding.]

These figures were not in any way "tests," but simply actual working results. They tried various admixtures of pitch, ranging from 3 to 7 per cent. With a 7 per cent. admixture, they found trouble with the ascension-pipes and hydraulic mains; so they dropped back again to 3 per cent., and gradually worked up to nearly 5 per cent. At the present time, they were using 5 per cent. of pitch admixture. The figures were complicated a little by varying circumstances; for at one portion of the time they were washing with heavy oil owing to naphthalene troubles. But the last seven weeks had been with tar. The temperatures were also different. Their own tests (which had yet to be confirmed at the laboratory) showed that more toluol was yielded during the last two months than in the preceding two months; so that the process was distinctly advantageous from this point of view.

The President (Mr. E. A. Harman) said that when Mr. Duxbury's figures were published members would doubtless take the opportunity of going more closely into this interesting matter.

ABSORPTION OF OXYGEN IN GAS ANALYSIS.

In a recent number of the "Berichte of the German Chemical Society," Herr Heinrich reported on the absorption of oxygen in alkaline solutions and on a new absorbent for oxygen. He has observed that a hydrosulphite solution prepared with solution of caustic soda, which has been recommended by Franzen for the absorption of oxygen, absorbs that gas much more slowly than a hydrosulphite solution prepared with a solution of caustic potash. For instance, the soda hydrosulphite solution took nine minutes to absorb the oxygen from 50 c.c. of air, whereas the same quantity of hydrosulphite, mixed with an equivalent quantity of caustic potash, effected the absorption of the oxygen in three minutes. It is thus advantageous, in using hydrosulphite as an absorbent, to prepare the solution with potassium hydroxide instead of with sodium hydroxide.

A similar difference in the action of potash and soda solution was found in the use of alkaline pyrogallol for absorbing oxygen. Various observers have shown that the rate of absorption of oxygen in alkaline solutions of pyrogallol depends to a large extent on their concentration; but the solutions of a concentration which will give the best absorption are not applicable in technical gas analysis, because they evolve carbonic oxide when applied to neat or slightly diluted oxide.

Herr Heinrich has found that oxyhydrochinone is a rapid absorbent of oxygen, which retains its efficieney for a long time. He produced the solution by preparing triacetyloxydrochinone according to Thiele's method from chinone, and boiling with concentrated solution of caustic potash. The solution thus obtained may be directly used for gas analysis without the necessity of first producing the oxyhydrochinone in the solid form. The solution absorbs oxygen very energetically; 100 c.c. of pure oxygen being completely absorbed in one to two minutes without a trace of carbonic oxide being produced. It is immaterial whether this absorbent is prepared with caustic potash or caustic soda.

New Stoking Machinery at York.

At the annual meeting of the York Gas Company, Mr. Alfred Procter, in moving the adoption of the report and accounts, said they had been seriously hampered in the disposal of residuals; and the restriction in public lighting and shop lighting had caused a substantial loss of revenue from the sale of gas. At the last meeting, it was intimated that the Board had adopted a scheme prepared by Mr. H. E. Bloor (the Secretary and Manager) for mechanical stoking and coke handling. The machinery had now been partially installed. The amount spent upon it during the year was £7613; and they confidently anticipated better results in working and considerable economy. Owing to labour shortage, it was not possible to maintain certain parts of the plant in efficient working condition in November; and the output had of necessity to be restricted for a few days. The fire at the works in the autumn was traced to a fault in a portion of the plant, which was not quite finished. The whole of the damaged apparatus had been replaced with modern plant of the highest efficiency. The necessary provision had been made for the extraction of toluol. This did not tend to improve the quality of the gas; but they were still able to maintain it above the statutory standard. Forty of the staff had enlisted; and during the year £715 had been expended in allowances. Notwithstanding restrictions and difficulties, the volume of business had increased during the year; and they were able to report an advance of 10¾ million cubic feet in the gas sold. The rise in the cost of manufacture of gas was £6324. It would have been much higher, but for forward contracts on favourable terms—a position which had enabled them to pay their way with the comparatively small increase of 2d. per 1000 cubic feet. Sales of gas realized £2861 more, and residuals £2384 more. The balance of profits amounted to £14,699, which was less by the sum of £440. They were only £998 short of the sum required for dividend; but the undivided profits amounted to £12,450, out of which it was proposed to take the money. The Board had come to the conclusion that it was necessary to make a further increase of 4d. per 1000 cubic feet in the price of gas. This would involve another reduction of dividend, and would fall with particular hardship on the Company, as it was only in 1912 that Parliament fixed the standard price and dividend. They were carefully considering whether action could be usefully taken towards obtaining relief. A dividend at the rate of 4 per cent. per annum was agreed to.

◆

Satisfactory Working at Weymouth.—That the working in the manufacturing department had been very satisfactory was the report the Directors were able to make to the proprietors of the Weymouth Consumers' Gas Company at the half-yearly meeting last Thursday. It seems that, as the result of a general overhaul of the plant and the adoption of improved methods of carbonizing, there has been a large saving of coal, through the yield of gas per ton being much greater. The sale of gas during the six months ended Dec. 31 was only slightly less than it was in the second half of the year 1914; the quantity sent out being 78,290,800 cubic feet, which was a decrease of 250,400 cubic feet, or 0·31 per cent. For the whole year, the quantity sold was 154,321,900 cubic feet, which exceeded the sale for 1914 by 6,503,000 cubic feet, or 4·39 per cent. An increase which was made in the price of gas of 6d. per 1000 cubic feet produced an amount which practically met the additional cost of coal. There were other increases, in wages and materials; but these were more than covered by the unusually good returns from residuals. There was a balance available of £7320; and out of this the Directors recommended the payment of a dividend on the ordinary stock for the half year at the maximum rate of 5 per cent. per annum, less income-tax.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Mr. Bradfield's Comparative Working Results.

Sir,—I very much regret to inform you that an error was made in my analysis [pp. 408-9]. The amount shown in the Gas Light and Coke Company's figures, as realized per butt of ammoniacal liquor—viz., 5s. 9·04d.—should have been 8s. 4·36d. This, of course, would mean a corresponding increase in the same item of the second table, from 3·79d. to 2s. 11·11d.

Would you kindly put a paragraph in your next issue in as conspicuous a position as possible acknowledging and correcting my error.

F. J. Bradfield.

Commercial Gas Company, Feb. 25, 1916.

Showroom Reform.

Sir,—May I be allowed, through your columns, to express my appreciation of the interest taken by your readers in my recent article on "Self Help for Showroom Attendants." This interest, I may say, is manifest, not only in the letters which have been addressed to, and published by, the "Journal"—and to which I now propose to reply—but also in numerous private communications, all of a distinctly encouraging nature.

I think it must have been clear to every one that my remarks in themselves, as well as the mere fact that they were ever penned, were a full recognition of the important service which an aspiring showroom attendant is in a position to render to gas and the undertaking he is employed by—always provided he is given, or is able to assume, some degree of initiative.

As to remuneration, it must be admitted that gas salesmen are not as a class overpaid. But I have endeavoured to suggest that showroom experience should be regarded rather as a means to an end than an end in itself; and looked at in this light, the position of the showroom attendant is probably no worse than that of men engaged in any other sphere of activity, and in process of laying, by practical service, a solid foundation for future progress. It would, perhaps, be useless to make any kind of appeal to the man who gauges his opportunities by the salary he is, for the time being, taking. The man is, or should be, of greater consequence than his job; and if observation serves me rightly, the only way any worker can demonstrate his fitness for promotion is to prove by his present efforts that he has a genuine claim to a higher salary than the figure he hopes to improve upon. Again, one has to take commercial conditions as one finds them; and I am afraid that the man who is always looking for encouragement is not likely to go far in the race. At the same time, I have every sympathy with the gas salesman in his desire to elevate his status; and I do not think it would be possible to evince that sympathy more sincerely than by pointing out to him the splendid opportunities which the nature of his work provides. The status of any class of workers is, after all, but the measure of their own average merit; and a gradual improvement of the latter correspondingly elevates the former.

I should like to add that, in my opinion, many responsible authorities show an indifferent regard for their own interests and those of gas by treating the position of showroom salesman as one which anybody can fill, and that it would be to the advantage of all concerned if due circumspection were exercised in selecting the showroom staff, which, when all is said and done, is often the only commercial link between an undertaking and its consumers.

Cyril G. Davis.

60, *Oxford Street, W., Feb.* 25, 1916.

Sir,—In your issue of the 8th inst., I notice that Mr. Cyril G. Davis has taken up the cudgels on behalf of the showroom attendants and their ethereal attainments. It is a subject that many have endeavoured to fathom in the past; but as salesmen we are still awaiting a fair breeze to waft us along into the elysian realms of success.

Our diplomatic efforts to create an impression that we are highly paid is rather against Mr. Davis's maxim—viz., "Be honest in your statements;" and it might end to the detriment of our pockets. The whole secret lies in making the position worthy of the man. The present recruits do not add lustre to the department; but capabilities are not the qualifications nowadays, as there are too many hereditary appointments. Our department has been a "blind alley" up to the present, and a reform is necessary.

Whether Mr. Davis's parables will bear the fruitage of success, depends solely upon the treatment meted out to shrowroom attendants in the future. Money is necessary for self-respecting, honourable maintenance; and if one requires the wisdom of a seer, one cannot expect to obtain it for a mere pittance. The majority of the salesmen have eaten of the tree of knowledge; but their power is very limited, and in several cases they are treated on a par with the labourers. Our voices have been crying in a wilderness, and we are subjected to petty tyranny, that even our souls are not our own.

We now place our claims in the scales of justice, trusting that our appeal will not be in vain. Let us feel that we have a position of dignity; and the result will be fruitful in more measures than one.

Another Showroom Attendant.

Feb. 23, 1916.

Sir,—I have read with interest the article by Mr. Cyril Davis, also the various letters of criticism which have appeared.

I agree with "Fair Play" that it is not just to expect a man to dress and live-up to a higher standard than his income will allow, as this, in my humble opinion, is the first step on the road to ruin, owing to the man eventually finding himself in debt, with the result that he resorts to the moneylender. His wages or salary should be sufficient to enable him to dress, &c., according to his position. Also, the word "attendant" should be abolished and "salesman" substituted; although during my experience in the gas industry, which is one of twenty-six years, I have never heard any of the public take exception when being referred to the showroom attendant.

I do not agree with the statement made by "Another Showroom Attendant" regarding the inspector—viz., the reason why at times it is found that a different type of fire has been fixed to that recommended by the showroom. It must not be forgotten that, in addition to the cubical space and window area being known, there is the question of the aspect of the room and the draught of the chimney to be taken into consideration; and this is, undoubtedly, the reason of the alteration being made at the time.

As regards the question of educational equipment and knowledge of the gas industry in general, "Showroom Attendant" is perpetrating a very grave error in making such a statement as he has respecting inspectors and assistant inspectors; for he must be fully aware that, before a promotion is made, the man has had to study many hours, attend lectures, and finally sit for an examination, where questions both on practice and theory have to be answered. Then, when the promotion has been given, the man has to serve twelve months on probation, during which period he has to give satisfaction not only to his superior officers, but to the public; and should the latter not be satisfied, a letter is very soon received at the office.

Finally, as to the question of writing letters. It is not a matter of the attendant being incapable of writing a letter, but the inspector is appointed in charge of a district, and is responsible for all that takes place therein. I feel the majority will agree that all letters should pass through the district inspector's hands, and be signed by him.

Inspector.

Feb. 24, 1916.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bill read a second time and committed: Burnley Water.

The following Bills are to be read a second time this day week:

Aberdare and Aberaman Gas, Colchester Gas, Ferndale Gas, Hornsey Gas, Imperial Continental Gas Association, Newcastle-upon-Tyne and Gateshead Gas, Yeadon Water.

Petitions have been presented against the following Bills:

Aberdare and Aberaman, by the Aberdare Urban District Council.
Colchester Gas, by the Colchester Corporation, and the Wyvenhoe Gas Company.
Hornsey Gas, by the Gas Light and Coke Company, Great Northern Railway Company, Hornsey Corporation, Wood Green Urban District Council and others.
Newcastle-upon-Tyne Gateshead Gas, by the Durham County Council, Felling and Hebburn Urban District Councils, Gateshead and the Newcastle-upon-Tyne Corporations, and the Trustees of the late Charles Perkins and W. E. Manners.
Yeadon Water, by the Guiseley Water-Works Company, Guiseley, Rawdon, and Yeadon Urban District Councils, West Riding of Yorkshire Asylums Board, Wharfedale Rural District Council, and S. C. Denby.

The Gas Light and Coke Company and other gas companies have deposited a petition against the South-Eastern and London, Chatham, and Dover Railways Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bills read a second time and committed: Beighton and District Gas, Folkestone Gas, Northwich Gas, Plymouth and Stonehouse Gas, South Metropolitan Gas, Tynemouth Corporation Water, Uxbridge Gas, Wakefield Corporation Water.

Water Supply at Naval Establishments.

Mr. Perkins, on Monday of last week, asked the Secretary to the Admiralty whether his attention had been called to the fact that the Admiralty was employing an official of the Metropolitan Water Board as their expert adviser in connection with the water supply of Admiralty works in Yorkshire; whether he was aware that the Metropolitan Water Board had no authority to deal with water supplies outside their own area; and whether, in view of the fact that many consulting engineers with local experience were at present only partially employed, the Admiralty would in future make use of their experience rather than consult a water authority without local knowledge and already fully employed in its normal duties within its own area?

Dr. Macnamara, in his reply, stated that the Metropolitan Water Board had placed the services of certain of their expert staff at the disposal of the Admiralty in connection with water supplies at various naval establishments, including that in Yorkshire, and this valuable assistance was much appreciated. The need of further expert assistance had not been experienced. The Admiralty were acting under their own powers in various districts.

Directorial Changes at Hexham.—No less than three vacancies on the Board of the Hexham Gas Company have been caused by death during the past year. Mr. Dixon Pratt had been a Director for 46 years (and Chairman for 15 years), Mr. W. R. Riddle, for 44 years; and Mr. Joseph Hepworth, for 16 years (previous to which he had been Consulting Engineer to the Company for 20 years). It was announced by the Directors in their report for the twelve months ended Dec. 31 that the vacancies had been filled by the appointment of Mr. W. Pattinson, Mr. F. N. Hepworth, and Mr. J. E. Gibson. The accounts showed a gross profit of £2159; and a dividend making with the interim dividend 5 per cent. for the year, less income-tax, was declared, leaving a balance of £1256 to be carried forward.

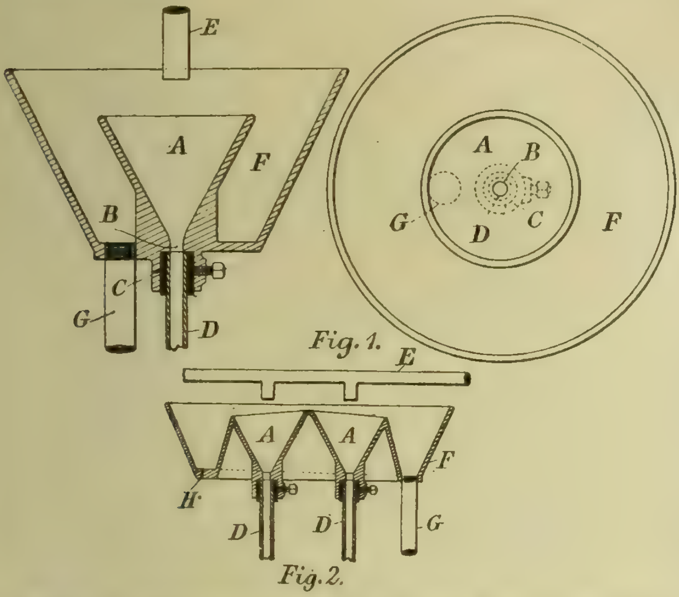
REGISTER OF PATENTS.

Feeding Apparatus for Liquids with Solids in Suspension.

Shewring, F., of Droitwich.

No. 21,301; Oct. 21, 1914.

This invention relates to a gravity-feed system of liquids having solids in suspension of such a character as will quickly settle out—such, for example, as a milk-of-lime supply to a sulphate of ammonia still. The object is to prevent the matter in suspension in the liquids settling out in the receiver and in the down pipe leading from it, and "the effectual return of the overflow liquid to the vessel in which the solution is mixed"



Shewring's Feeding Apparatus for Liquids with Solids in Suspension.

Fig. 1 shows a vertical section and a plan of an elevated receiver, combining a primary receiver and an overflow receiver. Fig. 2 is a smaller scale vertical section of an arrangement of the invention with two primary receivers adapted to overflow into a single overflow receiver.

In fig. 1, the primary receiver A is an upright vessel of cone shape through the bottom of which is the outlet B. The inner sides of the vessel are straight, and the outlet joins-up with the sides and leads into a larger diameter concentric socket C, formed on the underside of the receiver, without shoulder, rim, or any other part offering resistance to the free flow of the liquid through the outlet, and which would tend to wipe-out of the solution the solid matter in suspension. To the socket C, by an india-rubber ferrule and a clamping pin, is detachably fitted a glass tube D, forming part of the down pipe. It is similar to tubes used for steam-gauges, and of a diameter calculated to determine the actual size of the outlet from the receiver A. It is a feature in the fitting of this tube to the socket C and to the outlet B that no resistance is offered to the free flow of the solid matter in suspension in the liquid. E is a pipe by which the forced supply of solution is carried into the receiver, which forced supply is always in excess of the capacity of the outlet B D. The supply, being in excess, always maintains an overflow condition of the solution at the top rim of the receiver, and at the same time a constant agitation of the liquid in it. The overflow liquid passes into a second receiver F, which surrounds the primary receiver and is provided with an outlet pipe G for the return of the excess liquid to the solution mixing vessel. This second receiver is also a conical vessel with straight sides, and operates so that the solid matter in suspension is maintained in suspension and returned without settling-out to the solution mixing vessel.

In fig. 2, two primary receivers A are provided within an overflow receiver F, common to both. Each receiver is independent in operation, and has a separate down-pipe D. The rims of the receivers are arranged to overflow outwardly and not towards each other. Both receivers may be fed from a common supply pipe E. G is the pipe by which the overflow solution is returned to the mixing vessel; and with reference to the free flow from this overflow receiver to the pipe G, the bottom H is slightly declined towards the pipe G.

Grids for Gas-Purifiers.

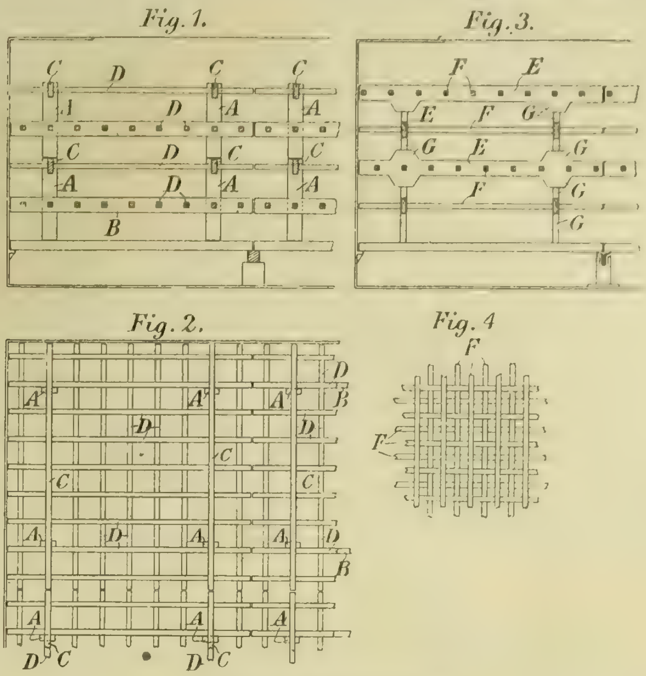
Tate, L. J. V., of Edinburgh.

No. 2644; Feb. 19, 1915.

The object of this invention is "to construct a grid for gas-purifiers, deep filled with purifying material, so that the material may be deposited and supported in a light porous condition, and to obtain a uniform flow of gas throughout the entire mass by splitting up any streams of gas that may form at any point in the purifier."

Fig. 1 shows in elevation an "intersection" grid with vertical and horizontal frame bars and the manner of fitting them in the purifier. Fig. 2 is a plan of fig. 1. Fig. 3 shows the "intersection" grids with horizontal frame bars only. Fig. 4 is a plan of horizontal rails for grids shown in fig. 3.

In figs. 1 and 2, the frame is formed of a number of vertical bars A, supporting four horizontal bars B and C. The two lower bars B are each fixed to two of the vertical bars A, thus forming two sides of the frame; while the two upper bars C are fixed to the vertical bars A of the two frame sides, and form a complete rectangular frame resting on the vertical supporting bars A with the two lower horizontal bars B running at right angles to the two upper horizontal bars C. The grid-bars D are morticed into, or fixed to, the respective tiers of horizontal frame bars B and C at any suitable distance apart, and the tiers of grid-bars run across the frame at right angles to each other in the respective tiers.



Tate's Gas-Purifier Grids.

In figs. 3 and 4 the frame is formed of a number of horizontal frame bars E with enlarged parts G, which form supports for the successive tiers of grids running parallel to each other. The horizontal grid-bars F are supported on the frame bars E at any suitable distance apart.

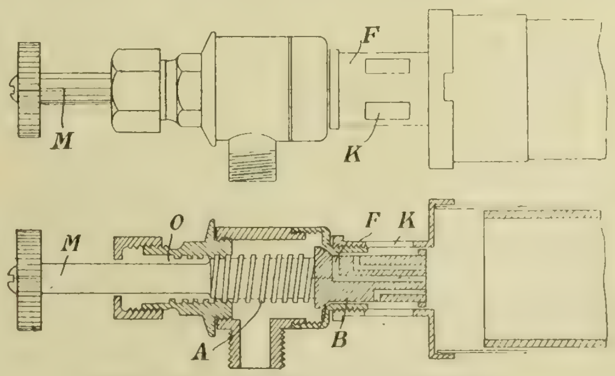
The grid-bars running at right angles to the grid-bars in the tiers above or below intersect the spaces between the grid-bars in the adjacent tiers, and thus intercept the falling purifying material as it is filled into the purifier from the top of the grids, breaking the fall and spreading the purifying material in all directions over a large area and ensuring that it is deposited in a light open condition, also the gas passing through the purifier, upward or downward, is intercepted in its passage by the lines of grid-bars, and is spread over the whole mass within the purifier.

Cocks for Bunsen Burners.

Billington, W. J., of Tooting, S.W.

No. 6021; April 22, 1915.

This atmospheric burner is of the type in which the shut-off valve for the supply of gas and the apertures for the supply of air are simultaneously opened and closed by operating a handle, so that the gas and air always bear a certain relation to one another.



Billington's Atmospheric Gas-Burner Cock.

An elevation of one form of the invention is given; also a longitudinal section, showing the parts in the position they would occupy when the valve is closed.

A screwed spindle A, co-axial with the part of the bend leading to (say) a stove, has upon it a plunger or piston B, with a conical edge adapted to fit upon a seating formed in a partition extending transversely across the pipe, and which forms the actual valve by which the supply of gas may be entirely shut off. Beyond the valve the aperture in the pipe is reduced—forming a cylinder F, which receives the piston B, "of such size as to fit snugly therein." In the plunger a series of fine holes are bored with right-angled bends opening at different points on the surface of the plunger. In the cylinder are drilled two or more holes K, so that a short bunsen tube is formed;

and within the cylinder the piston works up and down—forming with it the air-control valve.

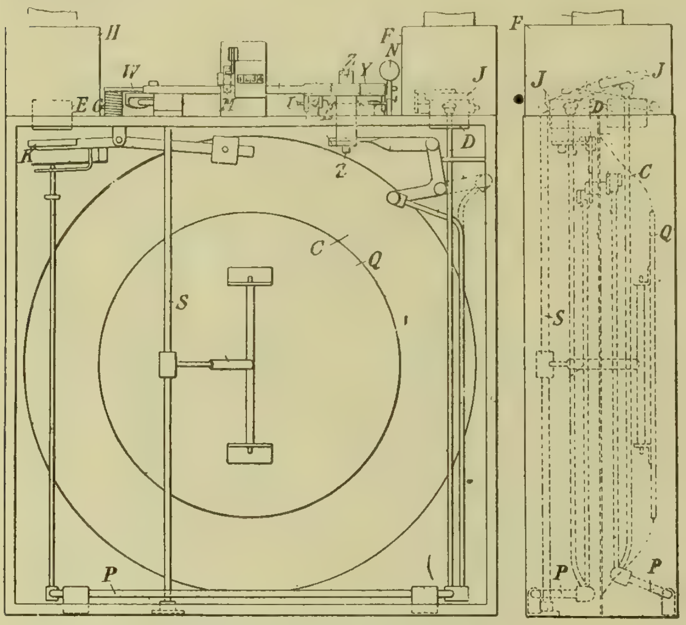
By turning the valve stem M, which passes through a threaded part O of the right-angled bend, the valve disc can be moved from its seating; and gas then passes through the first hole in the plunger. The gas cannot, however, make its way through the remaining holes, because it cannot reach their outer ends, which are within the cylinder. But as the stem is screwed further out, the plunger is moved into the enlargement of the pipe, and the outer ends of the remaining holes are uncovered one by one. Meanwhile, the holes in the cylinder forming the bunsen tube are gradually uncovered by the movement of the plunger—thus increasing the amount of air drawn in by the passing gas.

Dry Gas-Meters.

White, Jun., J., of Handsworth, and Canova, V., of Birmingham.

No. 5854; April 19, 1915.

This invention relates to dry meters in which poppet valves are operated intermittently with a quick motion at the end of each movement of an oscillatory diaphragm situated between a pair of measuring chambers. The invention comprises the combination with a lever on a shaft which receives its motion from an oscillatory diaphragm, of a rocking bar connected to the valves, a lever carrying a roller which can move along the bar, a lever to which the roller-carrying lever is attached at one end, a link connecting the roller-carrying lever to the first-mentioned lever, a pair of locking levers at the ends of the rocking bar—the locking levers being adapted to engage the rocking lever and to be disconnected from it by the roller-carrying lever, and operating springs or weights in conjunction with the levers acting on the rocking bar.



White and Canova's Dry Gas-Meter.

In the construction of meter shown, a rectangular case A is formed with a central partition in which is a reciprocatory flexible diaphragm C. At the upper side of the case two cylindrical apertures D E are arranged in conjunction with each chamber—a gas inlet and gas outlet respectively. The inlet apertures for the chambers have their outer ends enclosed in a compartment F, with which communicates the main inlet pipe, and similarly the two outlet apertures have their outer ends enclosed in a chamber H, with which communicates the main outlet pipe. Over the upper end of each inlet aperture is fitted a flat disc valve J, and beneath the lower end of each outlet aperture is fitted a disc valve K. The valves are mounted on levers; and motion is imparted to the valves by rods adapted to lift them off their seatings. The rods of each chamber are operated by their own rocking bar P; the arrangement being such that a closing movement of one of the valves is accompanied by an opening movement of the other.

As in ordinary dry gas-meters, the reciprocatory motion of the diaphragm is utilized for actuating the valves. The usual central plate Q on the diaphragm is connected to a vertical rocking shaft S, which projects through a stuffing-box in the top of one of the measuring chambers. To the end of the shaft is secured a lever, which (by means of a link) is connected to another lever which at one end is pivoted to a spring-controlled lever W and at the other end is provided with a roller which moves across a bar Y secured to a valve-operating shaft Z. During each oscillation, movement is transmitted through the mechanism described to the spring lever W, and the latter is moved during rather more than one-half of the motion against the spring G, which acts directly on the lever and may be supplemented by another spring connecting the lever W and the bar Y. During the movement the roller is moving idly along the bar on the valve-operating shaft.

The arrangement of the mechanism is such that, with the operation of the bars P, the positions of all the valves are rapidly reversed—that is to say, the open valves are closed and the closed valves are opened. The chamber which was previously receiving gas from the inlet is now caused to discharge to the outlet; and the other chamber is put into communication with the inlet. During the reverse movement of the diaphragm the roller again slides across the bar Y on the valve shaft; but no motion is imparted to the latter until a peg securing the bar to the locking lever I is disconnected from the lever by the action of the peg on a projection, then another change-over of the valves occurs. The locking levers are controlled by a spring L, so that they automatically engage the pegs on the bar Y. Simultaneously with the liberation of one peg on the bar the other peg is engaged. By arranging the valves as shown, the normal pressure of the gas tends to keep them on their seatings.

In conjunction with the lever W, a counter is provided to indicate the quantity of gas passed through the meter; and actuation of it is effected by an arrangement of links or levers acting on the ratchet M.

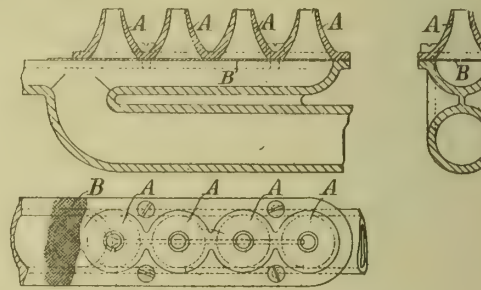
In the operation of the meter as described, the valves remain fully open throughout the greater part of each movement of the diaphragm and close suddenly at or near the end of it. Preferably the valves are arranged so that both inlet valves and both outlet valves remain open simultaneously for a short interval; and the gas commences its flow into, or out of, one of the chambers before the flow into, or out of, the other chamber is completely interrupted. An air-buffer N may be arranged in conjunction with the lever W to control the rate of operation of the valves and permit the reversal to be effected without shock or noise.

Burners for Gas-Fires.

Aird, Kenneth, of Falkirk.

No. 9369; June 26, 1915.

This invention consists in a two-part burner comprising a cover and a body, "the cover being formed with its lower face plane and with integral upwardly projecting nozzles, each formed with a conoidal cavity, the base of which coincides with the lower face of the cover, and each such cavity being contracted without an interruption from the base to the open end, and a plane foraminous sheet interposed between the cover and the body."



Aird's Burners for Gas-Fires.

As shown, the burner is in two parts, the upper part with integral upwardly projecting nozzles, each of which is formed with a conoidal cavity A, the base of which is contained in the plane of the lower face of the cover. Each cavity is contracted, without an interruption from the base to the open upper end of the nozzle. Interposed between the cover and the body part of the burner is a flat or plane sheet of gauze or perforated sheet metal B constituting a foraminous closure for each cavity, which otherwise is entirely open at the base.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Feb. 23.]

Nos. 2133—2532.

Behrens, J.—"Removal and obtainment of sulphur-dioxide from gases." No. 2280.
Dayton, W. C.—"Making gas from liquid hydrocarbons." No. 2441.
Hanappe, E.—"Washer-scrubbers." No. 2392.
Helps, G.—"Gas-cooking ovens." No. 2362.
Lewis, J. P.—"Cracking hydrocarbons." No. 2509.
Meads, H. J.—"Gas-lamps." No. 2230.
Morgan, F. J.—"Gas and air mixers." No. 2409.
Munro, H.—"Methods of illumination." No. 2314.
Naamlooze Vennootschap A. Jurgens' Vereenigde Fabrieken.—"Absorbing carbon-dioxide from gaseous mixtures." No. 2331.
Norddeutsche Hütte Akt.-Ges.—See Behrens. No. 2280.
Parkinson and W. & B. Cowan.—See Meads. No. 2230.
Price, A.—See Morgan. No. 2409.
Pryse, W.—See Morgan. No. 2409.
Pulsometer Engineering Company.—"Production of compressed gases." No. 2458.
Rollason, A.—"Treatment of coal." No. 2356.

Waltham Abbey and Cheshunt Gas Company's High Make.—At the annual meeting of the Company last Wednesday, the report submitted showed a profit on the year's working of £4680. After payment of an interim dividend of 7½ per cent. per annum on the "A" shares, and 5½ per cent. per annum on the "B," "C," and "D" shares, for the half year ended June last, and providing for the interest on debenture stock and loans for the year, as well as an amount of £190 transferred from the profit and loss account for writing-down investments, there remained a balance of £2766, out of which the Directors recommended the payment of a dividend of 8 per cent. per annum on the "A" shares, and 6 per cent. per annum on the "B," "C," and "D" shares for the six months ended Dec. 31, and that the balance of £824 be carried forward. Mr. Henry Woodall congratulated the Company on being in the position of paying ½ per cent. more dividend than last year. With regard to the output of gas, they had made 128 million cubic feet, against 103 millions the previous year; the increase being due to the fact that the Government were using a lot more gas at the factories. They had made 14,850 cubic feet of gas per ton of coal carbonized, and sold 14,036 feet, which he believed was a record for any gas company in the kingdom. The report was adopted.

MISCELLANEOUS NEWS.

CROYDON GAS COMPANY.

The Half-Yearly General Meeting was held last Friday, at the Offices—Mr. Charles Hussey, J.P., in the chair.

The Secretary (Mr. W. W. Topley) read the notice convening the meeting; and the Directors' report and accounts were taken as read.

Use of Gas and Coal Economy.

The Chairman, in moving the adoption of the report and accounts, said the history of the undertaking during the half year had in its main features closely resembled those of the preceding half year. In both, notwithstanding the reduction in public lighting, and the practical extinction of outside shop lighting, the Directors were able to record a slight increase in the sales of gas over the corresponding period of the previous year. As building was almost stationary in the district, this result had had to be achieved by an increased use of gas on the part of existing consumers. As the proprietors doubtless knew, the Government had in various ways indicated the desirability, in the national interests, of securing, through the medium of gas-works, the fullest results from the coal used in the country. It was worth while in this connection to consider for a moment the national advantages obtained by the utilization in this manner of the country's internal fuel resources. If a ton of coal was burned in a fire or furnace, a large portion of its volatile constituents were driven off into the air unconsumed, or partially unconsumed, in the form of smoke, which consisted in reality of wasted fuel. The same result followed if the coal were used under boilers which generated electricity. Not only so, but the valuable liquid and gaseous contents of the coal other than the gas itself—viz., tar and ammonia—were not recovered. Contrast this with the processes carried out in a gas-works, which furnished perhaps as complete an illustration of the fullest and most economical use of raw material as was to be found in the country. Here the coal was subjected to a process of distillation in closed retorts, which extracted from it, firstly, the gas, and next the tar and ammonia. The gas was subjected to various processes of purification, ending in the clean and adaptable fuel which consumers had always "on tap," and which could be used for lighting, heating, motive power, smelting, brazing, and many industrial processes by means of the efficient appliances devised by latter-day scientific research, and made available by the Company for the use of their customers. So from the gas when consumed they had a near approximation to the minimum of waste in use. The tar was converted by distillation and chemical treatment into substances almost unlimited in number, some of which were necessary for the production of munitions of war, and, as such, were urgently needed by our own and the Allied Governments for use by their armies. The ammonia was converted into the most valuable of artificial manures, sulphate of ammonia, the use of which the Government were urging upon the farmers to enable them to increase the home agricultural products, and thus lessen the necessity for imports, which at this time not only affected adversely the financial position of the country in the markets of the world, but increased the difficulties due to the inevitable shortage of shipping and the consequent high rates of freight. There remained the coke, which was a cleanly and smokeless fuel, burning with a high temperature, and giving, when fires or furnaces were suitably adjusted for its use, actually better results per ton than the ordinary qualities of coal, while the price at which it could be sold made it the cheapest solid fuel obtainable.

RECORD FIXING OF GAS-STOVES.

The Company were doing what they could to press these considerations home to the minds of the consumers, and that their efforts were not without success was, he thought, shown by the fact that the increase in the number of gas-stoves in use—3631 in the half year—very largely exceeded that of any previous half year in the Company's history. For the first time, the stoves hired from the Company (not counting the large number which had been bought outright) exceeded the total number of gas accounts—being 47,886, against 46,319. This naturally meant a very large amount of work falling to the share mainly of the distribution department. When he told the proprietors that, in the one year of 1915, they fixed or removed 23 050 stoves, to say nothing of 10,690 meters, to satisfy the requirements of their customers, it would be seen that, with a staff already depleted and almost daily being reduced by enlistment, those who remained to the Company (assisted it was true by the willing service of temporary male and female employees) had had no easy time. The proprietors would, he was sure, join with him in recognizing the way their employees had taken, and were taking, their share of the national burden in these trying times.

ITEMS FROM THE ACCOUNTS.

The accounts, enabling (as, in accordance with the custom of many years, they did) a comparison to be made with the corresponding figures of the previous year, called for little detailed comment. It would be seen that the chief feature was the large increase in the cost of the raw materials, which was partly offset by an increase in the receipts from residuals. Materials generally were much advanced in price. The charge for war bonus (to assist their men in meeting the increased cost of living), and for payments to dependants of men on service, would, he was certain, meet with the hearty approval of the proprietors. These payments were on a scale which had been carefully considered, and were designed, on the one hand, to ensure that no employee serving his King and country should feel anxiety as to the monetary welfare of those he left behind, and, on the other, to enable the Directors to maintain, as they hoped to do, and as he was sure the proprietors wished them to do, these benefits undiminished under the more difficult circumstances which would face them in the immediate future.

COAL, OIL, AND RESIDUALS.

The Company had not yet felt the full incidence of the charges due to the war. So far the raw materials had been largely received under contracts made in pre-war times. On seaborne coal, they had had to pay increased prices due to high rates of freight; these amounting at the present time to the equivalent of nearly 9d. per 1000 cubic feet of gas made. They had also purchased Midland coals at advanced prices, though the Act for the limitation of the price of coal had given them a little, if somewhat uncertain, relief. With regard to oil, the pre-war contract was just running out; and their purchases in the coming year would probably cost some £16,000 more under this heading alone. It was due to the firm who had been supplying them that he should acknowledge the way in which their contract had been faithfully carried out through times during part of which the freights ruling were as much as eight times those on which the sale price was based. This must have meant a heavy loss; but the Company's requirements had been fully met. The new contract was based on a rate for carriage six times the normal. But, being on a sliding-scale, if, as the Directors hoped might be the case, there was—if not immediately, then during the coming year—some easing of shipping freights, they might share in this relief. Be that as it may, they would have to pay in the near future much higher prices for their raw materials without the prospect of any proportionate gain from residuals, which, at the moment, showed rather a downward than an upward tendency, and which in any event could not be looked to for any considerable help towards the coming burden of higher costs.

POSSIBLE FURTHER INCREASE IN PRICE OF GAS.

The proprietors would not be surprised, therefore, when he said that, unwilling though the Directors were to raise the price of gas, some increase might in the near future be found unavoidable. So far the price had been increased by 4d. per 1000 cubic feet only, while neighbouring companies had found increases of 6d., 7d., and 8d. necessary. He believed that the consumers, should the Directors unfortunately find it impossible to avoid a further advance, would recognize that they were passing on to them as little as they possibly could of the additional expenses the Company were forced to incur, and that they had tried to defer any increase as long as possible.

WAR LOAN AND AIRCRAFT INSURANCE.

The Directors had converted their investments of Consols into 4½ per cent. War Stock; and the proprietors would see that the reserve and insurance funds were written-down in consequence. This conversion would, however, give a greater yield in interest, the whole of which was applied to the augmentation of these funds. A considerable expenditure had been incurred on insurances which the Directors last summer thought it wise to make against damage by hostile aircraft. They hoped that next year there would be no need for a recurrence of this expenditure.

DERELICT GAS-WORKS AND WAR REQUIREMENTS.

The gas-works at Whyteleafe, which were closed-down in 1906 after the amalgamation with the Caterham Company, had been let to a firm having a contract with the Government for army supplies. Here the Company would benefit from the rental received, and to a small extent from the use of gas. It was interesting also to note that, within the last few days, an inquiry had been received for the purchase, or rental, of the old gas-works at Carshalton, which had been unused for 21 years, or since the amalgamation with the Carshalton Gas Company. This inquiry also arose from war requirements.

CONSTRUCTION OF NEW GASHOLDER STILL IN ABEYANCE.

The large holder in process of erection at Waddon was to have been ready for use last autumn. Owing, however, to pressure of Government work and shortage of labour, the contractors (whose undertaking had been taken over by the Ministry of Munitions) had had for the present to suspend work; and, as a consequence, the Company had this winter been without the additional storage capacity upon which their Engineer had counted. Fortunately, the darkest days were unaccompanied by severity of weather. The Directors hoped that this summer might see the completion of the work, as without the holder they would, if next winter was a cold one, have to work under conditions of very great difficulty and anxiety to their Manager and staff.

THE CARRY-FORWARD.

The dividends recommended would enable them to carry-forward a sum less by only £58 than that which was brought into the accounts.

The Deputy-Chairman (Mr. Thomas Rigby), in seconding the motion, said he thought, under the circumstances the Chairman had mentioned, that the proprietors would agree that the half-year's working had been satisfactory.

Mr. A. W. Oke, referring to the excellence of the report, said that some of the proprietors no doubt attended the meeting feeling that the Chairman would probably have to paint the position in somewhat dark colours. He was sure that such proprietors would feel relieved that they could go away with optimistic feelings. There was no question that this was largely due to the prudence of the Directors and the officials in making such long and excellent contracts. But the Board and the officials must have been much hampered during the winter months through not having the new gasholder. In spite of all the difficulties, however, there was only, as the Chairman had told them, something like £53 less in the balance to be carried forward. When they remembered the price of gas was only 2s. 9d. in Croydon, he was sure that the consumers must be very grateful, and the proprietors, being under the sliding-scale, must also be thankful that they were able to enjoy substantial dividends, in spite of the difficult times. He spoke in approval of several points mentioned in the Chairman's speech, and said he should like to feel that the Chairman's opening remarks, regarding economy in the use of coal, could meet with a much wider audience. The most economical use was by burning the gas derived from the coal, so as to save the other constituents. The good results put before the proprietors were due to the application of science in the manufacture and use of gas; and what one would like to see in every gas balance-sheet was money spent in research with the view to further development.

The motion was unanimously carried.

The Dividends.

Sir Corbet Woodall said he was present that day contrary to advice, and upon condition that he did not attempt to make a speech.

But he felt the time was such that one ought, if at all possible, to be present at the meeting of the proprietors—not to neglect any duty. It was his pleasant duty to propose the payment of dividends at the same rates per annum as last half year—that was to say, 14½ per cent. on the "A" stock, 11¼ per cent. on the "B" and "C" stocks, 5 per cent. on the "D" stock, and 10 per cent. on the "E" stock, all less income-tax. A great satisfaction to them all was to know that these dividends had been earned. They had in the past half year made a much larger balance of profit than they did in the same period of the previous year. The profit on the working was rather more than £28,000; and they were carrying forward a balance practically the same as last year. Besides this, they had a sufficiency in reserve to pay, if he was not mistaken, some eighteen months' dividend. The Chairman had spoken of the fact that the circumstances in front of them were uncertain and risky. They all knew this quite well, and agreed with him. But the state of their finances was such as to enable them to look with a degree of complacency to the immediate future, which it was not open for everybody to do. The price of gas had been increased but slightly—only by 4d. per 1000 cubic feet. It was open to them (as the Chairman had suggested they might have to do) to further raise the price; but nevertheless he saw no reason in the present position of the Company why they should be downhearted. The nation was engaged in a great struggle, on which all their minds were fully fixed. They knew they were engaged in this for reasons that no question of personal loss would materially affect; and they were going on with it even though considerable personal inconvenience was suffered. At present they could hardly say the inconvenience had been very great; but whatever it might be, they were all of them, he was sure, prepared to meet it, and carry through the struggle to the end. If it meant a temporary reduction of the dividend, the proprietors would be ready to face it. At the present time, they could rejoice that the excellent dividend had been fully earned, and that there was no risk about the dividends in the near future.

Mr. WILLIAM CASH seconded the motion, which was unanimously adopted.

RE-APPOINTMENT OF DIRECTORS AND AUDITOR.

Mr. PERCY H. HALL proposed the re-election of the Chairman as a Director. After the speech they had heard from the Chairman, it needed no words from him to recommend this resolution to the acceptance of the proprietors. They were always pleased to see Mr. Hussey's genial presence at the meetings; and they felt the same at the Board. Under his able guidance, the proprietors might be sure the true interests of the Company would be observed.

The DEPUTY-CHAIRMAN, in seconding, said Mr. Hussey had been a Director nearly 26 years, and he was still "going strong."

The CHAIRMAN, in reply, spoke of the unbroken good feeling that existed between himself and the other members of the Board, and of the kind way in which the proprietors always received what he had to say.

Mr. CASH moved the re-election of Mr. Samuel Spencer, who, he said, had been a valuable Director ever since the amalgamation with the Carshalton Company.

Mr. W. J. RUSSELL, in seconding, said that one of Mr. Spencer's strong and valuable points was that he was always well informed regarding the prices of metals and metal goods. This made his services very useful to the Board.

Mr. SPENCER having acknowledged his re election,

Mr. CHARLES WEBB proposed, and Mr. SAMSON seconded, the re-appointment of Mr. F. S. Sloman as an Auditor.

VOTES OF THANKS.

Dr. G. H. RODMAN proposed a vote of thanks to the Chairman and Directors. He remarked that in times of stress such as those through which they had been passing, it was particularly their duty to give the Directors their grateful thanks. Had it not been for good work on their part, he was sure the proprietors would not have had anything like the favourable report that had been submitted at this meeting. The difficulties they had had to surmount had been considerable; but, under the conditions of stress, they had been extremely successful.

Mr. J. T. MAITLAND seconded the motion, which was heartily carried.

The CHAIRMAN, in his reply on behalf of his colleagues and himself, thanked the proprietors for their expression of approval. It was true they had had a great deal of anxiety during the half year. There was above all the anxiety as to obtaining the quantity of coal they required. Fortunately, they were able to get in a good stock in the autumn; and this had been most useful. On many occasions they had had to take out of store, which was not a thing they liked to do; but now they were able to put a little into stock, and so supplement it. They had also (so to speak) been "commandeered" by the Government, and had had to put down certain plant for the extraction of toluol from the gas. This had not been an expensive matter; but it had given their Engineer and Works Manager (Mr. Caddick) rather more to do. Proposing a vote of thanks to the officers, their staffs, and workmen, he said that Mr. Caddick had had a great deal of anxiety in common with the Directors, and especially in connection with the supply of coal. Mr. Topley was, as ever, an indefatigable worker for the Company; and their Distributing Engineer and Sales Manager (Mr. W. J. Sandeman) had had a very pressing time during the half year, as was shown by the statistics he (the Chairman) had given in his speech. The time had been made more strenuous by the number of men who had gone to the front. When he mentioned that 230 of their staff and employees had joined the Colours, and it was expected that shortly another 100 would go, the proprietors would appreciate the difficulties there had been in carrying on their business. But the men remaining had made up their minds to as far as possible fill the vacancies by working later and by putting as much zeal as they could into their work. Mr. Haines, the chief of the rental department, was unfortunately ill; but, with the rest he was having, the doctor hoped he would soon be able to return. In Mr. Anderson they had, as Mr. Topley would acknowledge, an able assistant in their secretarial work.

Mr. SPENCER seconded the motion, which was heartily carried.

Mr. CADDICK, on behalf of all engaged at the works, sincerely thanked the Chairman for his kind words and the proprietors for their confirmation. They were, he said, indeed living in strenuous times; and, for any chief of a gas-works at the present time, the office was no sinecure. He could not speak too highly of the efforts his staff and men had put forward in these troublous times, to assist him in every direction. In connection with the subject of coal stocks, he mentioned, as a point of interest, that, at the beginning of September, they had about 30,000 tons of coal in stock, while their normal stock at that time of the year was about 15,000 tons. Their stock that day was about 15,000 tons; so that the proprietors would see the wisdom of the Directors in having given him the necessary permission to put down larger stocks of coal. Had they been satisfied with their normal quantity, it was easy to see the position now would have been very precarious; they would have been practically out of coal, instead of having six weeks' supply in hand.

Mr. TOPLEY, on behalf of the clerical staff, also thanked the Chairman for his kindly references to their work in these trying times, and the proprietors for their endorsement. He also took the opportunity of tendering his personal acknowledgments to those who had worked with him during the half year, and not least to those of whose temporary service the Company had availed themselves.

Mr. SANDEMAN, in the course of his reply, said the Chairman had mentioned that the Distribution and Sales Department had had a strenuous time during the half year. He (Mr. Sandeman) very cordially agreed with him. They had had an enormous amount of work with which to deal; and they had had to do this with a depleted staff. He was proud to say the staff and workmen had done their best to keep things going; and the balance-sheet showed they had been successful.

SOUTH SHIELDS GAS COMPANY.

Mr. J. H. Penney's Long Service.

The Annual General Meeting of the Company was held last Thursday—Mr. JAMES READHEAD, J.P., presiding.

The report submitted stated that the abnormal situation created by the war has caused a decrease in gas consumption of 5·7 per cent., due to the abolishing of public lighting and restricted lighting generally. The revenue account showed a decrease of £2430 in receipts, and of £1548 in expenditure. The prices of all materials had advanced, and wages had been increased by the war bonus. Residuals had yielded £427 less than the previous year. The price of gas was increased 2d. per 1000 cubic feet from July 1, which necessitated a corresponding decrease in the dividend payable under the sliding-scale. The Jarrow works reconstruction was not yet completed; but gas was being made there, and also at South Shields. The works were insured for damage by aircraft or bombardment. In August last, the Secretary (Mr. J. H. Penney) completed 50 years' service with the Company; and the Directors, on behalf of the shareholders, presented him with a silver salver and a cheque in commemoration thereof.

The CHAIRMAN, in moving the adoption of the report, remarked that the income for the past year was £107,803, and the expenditure £86,397; leaving a profit on the year's working of £21,406, which was just sufficient to pay interest and the statutory dividends and to carry forward £304 to the current year, after writing-down investments in Consols to the extent of £514. Owing to the increased cost of labour and material, the price of gas had to be increased 2d. per 1000 cubic feet as from July; and this necessitated, under the operation of the sliding-scale, a reduction of the dividends payable for the second half year. Though coals had cost more per ton than in the previous year, the total amount paid for coal and oil was less by £723, due to the smaller quantity used by reason of the decreased gas consumption caused by the war. The war had prevented the completion of the Jarrow works reconstruction scheme; and it was unlikely that it would be completed this year. During the past year, the Company had paid in wages £25,864, including war bonuses to workmen; and a further war bonus had recently been granted. Over 50 per cent. of the employees had joined the Colours or attested—practically every one of military age having attested. This was a most creditable record. Major Chapman, one of the Company's Auditors, had been awarded the D.S.O. Their reserve funds amounted to £31,366. He alluded to the absence, through indisposition, of the Secretary (Mr. J. H. Penney). This was the first annual meeting at which Mr. Penney had not been present during his long service as Secretary to the Company. In conclusion, the Chairman warmly congratulated Mr. T. H. Duxbury (the Engineer) and his staff on the satisfactory way in which they had got through a strenuous year.

The resolution was agreed to, and a dividend was declared on the consolidated and new stock at the rate of 4 per cent. (less income-tax) for the half year ended Dec. 31 last, making a dividend for the year of 8¼ per cent., and a dividend on the ordinary stock of 2⅝ per cent. (less income-tax) for the half year, making a dividend for the year of 5⅝ per cent.

Cowes Gas Undertaking Finances.—With regard to the sale of coke at the gas-works, it was suggested at Tuesday's meeting of the Cowes District Council that, in view of the high price of coal, ratepayers should be able to purchase it at a lower price than persons outside. Alderman Fellows said they experimented in trying to sell things cheaply last year, with the result that they came out with an adverse balance of £1000 on the operations of the gas-works; and the price of gas had to be increased 9d. per 1000 cubic feet.

Mirfield Gas Company.—The profit made by the Company on revenue account for the year ended Dec. 31 amounted to £6001, out of which the Directors recommended that a dividend should be paid at the rate of 5 per cent. per annum on the ordinary stock, less income-tax. In recording with regret the loss through death of Mr. Marmaduke Fox, who was for twenty years a member of the Board and for sixteen years Chairman, the Directors intimate that they have decided for economic reasons not to fill the vacancy on the Board thus created, "during the existing abnormal conditions, or until the termination of the war."

PORTSEA ISLAND GASLIGHT COMPANY.

The Half-Yearly Meeting of the Company was held last Thursday, when Mr. R. Edgcombe Hellyer (the Chairman) presided.

The Chairman, in proposing the adoption of the report and accounts, pointed out that, compared with the corresponding period of the previous year, the result of the half-year's working showed a reduced gross profit of £1764; and in order to pay the statutory rate of dividend, as recommended, it would be necessary to again draw upon the balance at the credit of the profit and loss account brought from the previous half year. Having regard, however, to the general increase in the cost of all materials and labour, and the continuance of the normal charge for gas, he thought the result was one with which the shareholders had every reason to be satisfied. Referring to the great difficulties experienced in consequence of conditions created by the war, he stated that every possible effort had been made to build-up reserve stocks of coal and oil during the summer; but, unfortunately, their efforts had not proved successful. Owing to the irregular deliveries of coal and oil, especially by sea, during the winter, it had been necessary for a time to reduce the pressure of gas throughout the district. This course had been taken with great reluctance by the Directors, as it was quite realized that it would involve considerable inconvenience to the public; and he wished to avail himself of this opportunity of thanking the Corporation and consumers generally for the consideration that, at such times, they had shown. Not only had there been difficulties with regard to obtaining materials, but, as was general in all industries, from the serious shortage of labour. Of the Company's men, 224 had already joined His Majesty's Forces, or were employed on munitions work, and an additional 153 had attested, making 377, or 53 per cent. of the total employees who had offered their services in the country's defence. As a large number of the other men were beyond military age, he considered the record was one of which the Company had every reason to be proud. The demand for gas had been prejudicially affected by the more stringent regulations of the Military Authorities, the cessation of building operations, and the temporary inability of the Company to execute orders for cookers, gas-fires, &c.; the last being due to the difficulties in obtaining the appliances, and the great reduction in the number of fitters. Notwithstanding these conditions, however, the gas sold was 3,000,000 cubic feet in excess of the latter six months of last year; while the number of consumers was increased by 759 to 50,673, and 992 more additional hired cookers and heating appliances had been fitted. He thought that, having regard to the very great increase in the price of coal and oil, and requisites generally, the necessity for increasing the price of gas would be fully appreciated. The new contracts for coal had not been completed; but for oil the Company were now paying over 100 per cent. in excess of last year's prices. This item alone would involve an additional expenditure of, approximately, £20,000.

The report and accounts were then adopted; the retiring Directors and Auditor were re-elected; and the usual donation of £50 to the Portsmouth Portsea, and Gosport Hospital was granted.

A vote of thanks to the Chairman and Directors, the Engineer and General Manager (Mr. J. D. Ashworth), the Secretary (Mr. H. A. Stibbs), and the staff, for their efficient management of the Company's business, was proposed by Mr. F. Blake. In reply, the Chairman said that it had been an extremely anxious time for all concerned, and for Mr. Ashworth in particular.

NEW SHOW-ROOMS AT DERBY.

Reference was made by the Chairman of the Derby Gas Company (Colonel G. Gascoyne) at the recent annual meeting [*ante*, p. 429] to the Company's new show-rooms; and an invitation was extended to the consumers to visit the premises, and see the latest gas appliances. He spoke of the credit that was due to their Architect (Mr. Thorpe), and the various contractors, "for the skilful manner in which they had carried out what he was informed was a new departure in show-rooms." The following particulars regarding what has been done have since appeared in the "Derbyshire Advertiser."

The rooms are beautifully fitted up with oak panelling, and present a most attractive appearance; while on the various mantelpieces over the latest styles of gas-grates are to be found some very attractive specimens of Royal Crown Derby china. The use of gas fires has increased very rapidly during the past two or three years; for the question of whether gas-fires are healthy to use has been conclusively answered in the affirmative by the medical profession on many occasions. The Company have on exhibition several splendidly designed grates with an artistic finish which are sure to meet the most fastidious tastes—some being in steel, some copper, and others black; while there is also a very neat device for fitting into existing fire grates, which, when heated, presents the appearance of a good coal-fire. A speciality is made of self-contained steam-radiators for heating schools, halls, &c.; while there is on view a safety gas-radiator for use in the garage. There is, in addition, a hot-water radiator for the garage or greenhouse. With regard to house lighting, everything is on the most artistic lines; and there is a surprising variety of fittings, shades, &c. Moving pendants for guiding the light in any direction are sure to prove a boon; while pneumatic distance lighters are exceptionally handy. Perhaps the greatest novelty of all is the "Telephos" electrical lighter, by which the lamps in the room may be turned on by merely pressing a button. For this purpose, no bye-pass is required, the whole thing being worked by a small dry battery about the size of the pocket flash light variety. Another lighting contrivance takes the form of the ordinary electric light switch in appearance; but in this instance a bye-pass is used. The domestic gas appliances are equally ingenious and handy. Several great improvements have been made in cooking stoves, such as plate-racks, enamelled and plated fittings and backs to keep the walls clean; while a handy contrivance hangs on the side—namely, Stone's little bye-pass—which is always ready to light the burners, and so save matches. Aluminium utensils are also on exhibition. A most useful combination of very small dimensions, which, on the old lines, could only be used as a grid or for toasting, has now been adapted for baking—the heat being evenly distributed. For use in summer, the Company have a very handy and efficient auxiliary water-heater for attaching to the kitchen range; so that there is still a good supply of hot water after the fire is out. This is controlled by an automatic valve which turns down the gas as soon as the water is hot, or *vice versâ*, when the water-taps are turned on; thus economizing considerably in gas. Similar appliances on smaller lines—namely, self-contained boilers—are sure to be found most useful for the lavatory basin, or in the hairdresser's shop. A hot-water geyser for the bathroom has been so designed that after a few seconds, when the tap is turned on, the gas is automatically lighted and the water heated as it passes through the geyser; but there is no danger of the heating pipes getting burnt, for the gas is only alight while water is passing through.

WAKEFIELD GASLIGHT COMPANY.

Alderman G. A. Moorhouse, J.P. (Chairman), in presenting the report and accounts for the past year at the annual meeting of the Company on Monday of last week, said that, owing to the greatly increased prices of coal and all other materials, they had been compelled to raise the price of gas last Midsummer 4d. per 1000 cubic feet, which necessitated a reduction of the dividend of 1 per cent. The balance-sheet was very satisfactory, as it showed that the balance of revenue account was practically the same as last year—£12,733, as compared with £12,730; and as they were compelled to pay a smaller dividend, the carry-forward was increased by the sum of £1593. There had been a falling-off in the consumption of gas amounting to 7,241,000 cubic feet, or 2·39 per cent., which was entirely due to the restricted public lighting. The make of gas per ton of coal (12,153 cubic feet) was their highest on record. For the first time in the history of the Company, purification had been a source of revenue. It had cost nothing, and had yielded a profit of £207; whereas a few years ago purification cost them regularly from £1000 to £1200 per annum for a smaller production of gas. The year had been most harassing. The difficulty of getting coal, the scarcity of carters, the depletion of the staff and workmen, the requirements of the Ministry of Munitions, and the consequent increase of naphthalene troubles, had made the year one of great strain on the Directors and officers.

In moving a vote of thanks to the managing and secretarial staffs, Alderman W. H. Kingswell, J.P. (one of the Directors), spoke in the highest terms of the devotion shown during this trying period.

IPSWICH GAS COMPANY.

In the unavoidable absence of the Chairman (the Right Hon. Sir Daniel Goddard, M.P.), owing to his being a member of the Franco-British Parliamentary Committee, the annual meeting of the Company, on Monday of last week, was presided over by Mr. F. Fosdick, J.P. (the Vice-Chairman); but a written statement by the Chairman, referring to the year's working, was read to the proprietors.

In this, it was pointed out that the average rate paid for bringing coals to Ipswich from the North in pre-war times was about 3s. 6d. per ton; but last year no vessels could be chartered for twice this sum, and they had had to pay as high as 15s. a ton for a German interned boat—an awkward and unsuitable craft for discharging with grabs, but the only vessel available. Nor had the "boom" in freights reached its highest point in 1915; for early in the present year the Admiralty took the s.s. "Holmside," of 1200 tons burthen, which the Company had chartered to bring coals at a reasonable rate up to next June, forcing them into the market, where they had to pay 17s. for the only vessel offered. It seemed a pity that the Government, when limiting the price of coal, did not go a step farther, and restrict the rates of freight for carrying the coal to public utility concerns. He was glad the Government now seemed to realize that something must be done in this direction. In addition to providing material for explosives, the use of gas in Ipswich had played an important part in the manufacture of munitions—being extensively utilized in the large works of the town in a variety of processes in shell manufacture. They had also provided their quota of men to the forces; no fewer than 60 having joined the Colours (representing 35 per cent. of the employees), and 20 others having attested. There had been an increase during the year of 2½ per cent. in the amount of gas sold; and the make per ton of coal had improved from 12,435 to 12,672 cubic feet. Owing to the Lighting Restrictions Order, the Company offered to cancel the existing public lighting contract; and this had been accepted by the Corporation. For it, the Company had substituted an agreement at a slightly enhanced rate for such lamps as might be lighted during the war, and a nominal charge towards wear and tear in respect of those which were for the time being unlighted. Co-partnership cost £20 more; the rate of bonus being the same on a larger wage-bill. He was pleased to say they now had 35 of their employees who were shareholders in their own right. In consequence of the increase in the price of gas, the bonus would be less in the current year; but he hoped the reduction would be only temporary. Allowance to employees on war service appeared for the first time. In addition, work would be found for those men who had retained their connection with the Company, when they returned, as they trusted they all would do. He was happy to be able to report that up to the present there had been no casualties among the men, though some were on sick leave.

The meeting unanimously adopted the report, which stated that, after paying the interim dividend, the balance of profit and loss account was £19,446. The Directors recommended that a further dividend at the statutory rates allowable on the increased price of gas be paid. A balance would then remain of £14,017. Owing to the great advance in the cost of coal and rates of freight, the price of gas to ordinary meter consumers had been increased since June last by 4d. per 1000 cubic feet. With the exception of tar, better prices had been realized for residuals.

BOURNEMOUTH GAS AND WATER COMPANY.

The Ordinary General Meeting of the Company was held last Friday at the London Offices, No. 90, Cannon Street, E.C.—Mr. G. Crispe Whiteley in the chair.

The Secretary (Mr. H. A. Plumb, F.C.A.) read the notice calling the meeting, and the Directors' report and the statement of accounts were taken as read.

In the Circumstances, Highly Satisfactory Results.

The Chairman said he had the pleasure, and it would have been an equal pleasure with past years were it not for the extraordinary conditions under which they were living and carrying on business, to present a report which, under other circumstances, would have been considered by the proprietors as thoroughly satisfactory, but which must be looked upon in a somewhat different light at the present time. The report before the shareholders showed a very satisfactory increase in the sale of gas; for whereas there was a decrease of no less than 69 per cent. in the public lighting, this was more than made up by an increase of 8 per cent. in the consumption of the ordinary consumers, and 8 per cent. in that of the prepayment consumers, so that a general increase of 2 per cent. could be reported. The residuals had done well, and more than well; and the water-rental had also increased in a most gratifying way. Perhaps the most remarkable thing the accounts showed was the excellent sale of cookers, fires, and water-heaters; for, during the year 1915, they had taken for such appliances no less a sum than £16,000, which was easily a record in the history of the Company. With these facts before them, the proprietors would not be surprised that the Directors were suggesting the payment of the statutory dividends, and yet have an increased carry-forward.

COAL AND THE FUTURE.

So far so good; but—and there was a very large "but" in this case—the Directors had not only to tell the proprietors what had happened during the six months in order to get this report, but, as the proprietors would realize, the Board had also had to prepare for the future, which was certainly not so rosy as they would like it to be. The history of the six months had been one long and continuous struggle as to how, when, and where they could obtain coals, and, when they had bought them, as to how they could get them into their stores. Under the circumstances, they had, of course, had to increase the price of gas, which carried with it a corresponding reduction in the dividends and in the employees' bonus. Therefore, with what he could not but help considering was the excellent system under which they worked by Statute, the consumers, the proprietors, and the workers were all taking their share in the troubles that surrounded them. He could assure all concerned that, once the Directors could see their way clear to acquire coal and place it upon the works at anything like a reasonable sum, down would come the price of gas, and up would go the dividends and the workers' bonus. But, as he had said before, the time was not yet. The future did not look particularly brilliant; and he could at present hold out very slight hope of a mitigation of the troubles they were passing through.

THE RESERVE FUND.

There was one matter with regard to the accounts to which he should like to draw attention. That was the manner in which they had dealt with the reserve fund. The 2½ per cent. Consols had been converted into 4½ per cent. War Loan stock. The proprietors would not be surprised at this, or at the ascertained depreciation they had charged to the reserve fund. Of course, there was further depreciation still uncovered; but no good purpose would be answered by writing-down the securities at the present moment. They were unrealized securities; and the value of part of the depreciation might be recovered before they had any need, if ever, to deal with them.

WORKS, MEN, AND MUNITIONS.

Speaking generally, he had really said all that could be said wisely on the present occasion. The works and distribution system had been maintained in the usual way; but they had postponed much work which would have been done under happier circumstances. The proprietors would be pleased to hear that at least 200 of their men were serving with the Colours; and although many had been wounded, he was glad to be able to report that only two had been killed, which was a very small proportion. The Company were doing all they could to aid the Government, under the existing circumstances, to provide training accommodation for new troops; and the old works at Bourne Valley were now being used as a training-ground for 700 men. With regard to munitions, they had rendered material assistance to the Munitions Department, although perhaps, it would be neither wise nor permissible to give details as to the methods in which this had been done. That was the report—satisfactory in some ways, otherwise in some. They had had, and were having, very anxious times. He could only promise the proprietors that the Directors would use their best endeavours to carry out the work of the Company as well as it could be carried on under the adverse circumstances. On the whole, he might congratulate the proprietors on the fact that the Company had not been so unfortunate as they might have been. He moved that the report and accounts be received, adopted, and entered on the minutes.

Sir Corbet Woodall said he should have been content simply to have seconded the resolution, but he thought the proprietors ought to realize that, while there were unsatisfactory circumstances in front of them, these were not of a special or unusual character. The Company were, in fact, in a singularly good situation, having regard to the state of the country. They had in the past half year, as the proprietors knew, added to the amount of the carry-forward after paying their full dividends; they were also paying a considerable sum this half year, in common with other half years (their reserve fund was untouched) to depreciation for the writing-off of the value of abandoned works, and yet they had only increased the price of gas by 4d. per 1000 cubic feet, which was certainly less than the average of their friends and neighbours. They were fortunate in a contract for the conveyance of the greater portion of their coal at a comparatively low rate; and therefore the prospect in front of the Company was, he thought, as good as that of any company of which he knew. Of course, the time was full of anxiety; but he saw no reason why they should look gloomily upon it. The Board would, as the Chairman had promised, do all in their power in the circumstances; and he thought they were in a position to do as well as they could possibly expect. This being so, he had great pleasure in seconding the motion.

The motion was unanimously carried.

The Dividends.

The Chairman moved, and Mr. William Cash, F.C.A., seconded, the declaration of dividends at the following rates per annum: On the preference shares 6 per cent., on the ordinary shares 7 per cent., and on the original shares 15 per cent, all less income-tax.

This was agreed to.

Election of Directors and Auditor.

The Chairman next moved the re-election of Sir Corbet Woodall to his seat at the Board. He remarked that it was about nineteen years ago that the state of the Board was fairly critical, owing to death and ill-health. They were in straits with regard to members of the Board; but one morning a (he thought he might call it) happy inspiration led him to take a cab and go to Westminster, and invite Mr. Corbet Woodall (as he then was) to come and help in the work of the Company. He (the Chairman) was glad and delighted that the invitation to which he had referred was accepted; and he thought that he had never done a better morning's work than when he took that short journey to Westminster. The Company had since had the services of Sir Corbet; and they had been of the highest possible value. He was sure he was only emphasizing the desire of the proprietors when he asked Sir Corbet to continue to serve the Company.

Sir Charles J. Jessel, Bart., in seconding, remarked that Sir Corbet Woodall was the *doyen* of the gas industry, and his presence on any Board was an honour to his colleagues and a great advantage to the proprietors.

The motion was heartily passed.

Sir Corbet Woodall having acknowledged his re-election,

Mr. Arthur Woods moved the re-appointment of Mr. F. G. Barrett as an Auditor, and that the fees of each Auditor be increased to 110 guineas per annum. Their last increase in remuneration was in 1909; and since then the Wimborne Water-Works and the Christchurch gas undertaking had been acquired; and the business of the Company had been very largely increased.

Mr. A. W. Oke seconded the motion, and it was adopted.

Mr. Barrett thanked the proprietors for his re-election, and for the increase in remuneration.

Votes of Thanks.

Mr. R. H. Glen, F.C.A., in proposing that the thanks of the proprietors be given to the Chairman and Directors, the officers, their staffs, and the workmen, observed that they all more than usually deserved this recognition

Mr. Barrett seconded the motion; and it was cordially passed.

The Chairman said the Board and himself accepted the vote of thanks with a great amount of pleasure. During the long number of years the proprietors had placed their confidence in him, his conscience had sometimes pricked him as to whether he had really justified the confidence; but when he reflected on the success of that journey to Westminster to get their friend Sir Corbet Woodall to join the Board, he felt that, if he had never done anything else for the Company, that journey was not a lost one. It was a great many years since he himself first came on to the Board; and he thanked the proprietors now, as he had often thanked them before, for their kindness, and for the confidence placed in him. He also thanked them, on behalf of his colleagues, very sincerely for the recognition of their efforts. He desired to add that the Board most cordially joined in the thanks passed to the officers, their staffs, and the workmen. Their officers had really had most anxious times; and upon no one had the anxiety been placed more strongly than upon their Acting Manager, Mr. Moon. He had most admirably and splendidly risen to the occasion. His continuous activity carried out not only the wishes of the Board, but his own ideas and views as to the best ways in which to meet the extraordinary circumstances. The manner in which they had been met had impressed the Board very deeply. Their Secretary, too, had had a great deal of work to do in connection with these anxious times; and by him the additional work had been well done.

Mr. P. G. G. Moon, on behalf of the staff at Bournemouth, thanked the proprietors for their vote of thanks, and the Chairman for his kind words. Needless to say, without a most loyal and energetic staff, the Company could not have carried on. He was very pleased to have the opportunity of testifying to the exceptional manner in which every member of the staff at Bournemouth had co-operated with him in doing his duty in times that made very considerable demands on them all, and especially was this so of the workmen. In these times of unrest, their men had been consistently loyal. They had a very changing staff now, but they were very proud of the fact that 200 of their men had gone out to do their work for the country, and that of their staff, or rather of their staff immediately prior to the outbreak of war, no fewer than ten had taken commissions. His own predecessor—Mr. Duckham—who was closely connected with the Company, was now Assistant Deputy Director of Munitions. They took some amount of pride in this fact. And last, but by no means least, they had Major Woodall, of whom they were all very proud. The proprietors would be pleased to hear that he was now on the headquarters' staff of the First Division at Peshawur, understudying the Assistant Quartermaster-General. He (Mr. Moon) often heard from him; and his interest in the doings of the Company was keener than ever, which was saying much. They all hoped that peace would again soon bring his inspiring personality to Bournemouth. They had had their difficulties at Bournemouth, as the Chairman had told the proprietors. But he did not want to enlarge upon them. The great thing was that up to the present they had managed to overcome them.

Mr. Plumb also acknowledged the vote on behalf of the staff and himself.

NEWCASTLE AND GATESHEAD WATER COMPANY.

The Seventy-First Annual General Meeting of this Company is being held to-day, when the Directors will submit to the shareholders the balance-sheet and accounts for the twelve months to the 1st inst.

The gross receipts amounted to £234,600; and the expenditure and working charges, including management and maintenance, to £64,651. This leaves a balance of profit of £169,949, added to which was the balance brought forward from last year, £11,340, or a total of £181,289. There has already been paid interest on the debenture stock and loans, £38,423, and interim dividends for the half year to August last, £57,248. Out of the balance of £95,671, the Directors recommend that final dividends be paid for the last half year of 5 per cent. per annum on the preference stock, £27,626; at the rate of 10 per cent. per annum on the consolidated ordinary stock, making (with that paid in August last) 8½ per cent. for the year, £19,419; and at the rate of 7 per cent. per annum on the ordinary stocks under the Acts of 1876 and 1898, making (with that paid last August) £5 19s. per cent. for the year, £22,897. There will then be a balance carried forward of £15,675.

In their report, the Board remark that the surplus shown by the accounts seems to justify a larger dividend than that recommended; but the Directors, in view of what they can only regard as an abnormal consumption, and with the uncertainties of the present time, feel they are acting prudently in carrying forward a substantial balance.

The capital expended for the year (apart from ordinary pipe extensions and meters) was only £796.

The report continues: Since the last annual meeting the Directors have had to deplore the death of their late Chairman (Sir Andrew Noble, Bart.), who was a Director for 32 years, and who enjoyed the confidence and esteem of his colleagues and the proprietors. The Directors have appointed Mr. John Meade Falkner, the Chairman of Sir W. G. Armstrong, Whitworth, and Co., to fill the vacancy thus created. Mr. John C. Hamilton, who has been a Director for 34 years and Vice-Chairman for the last 13 years, has been unanimously elected by his colleagues as Chairman of the Board.

The following are the lengths and dimensions of pipes laid during the year for extensions and military and other works :—

2 inches	3,482 lineal yards	10 inches	9 lineal yards
3 ,,	3,828 ,,	12 ,,	432 ,,
4 ,,	3,510 ,,	15 ,,	28 ,,
6 ,,	2,304 ,,		
8 ,,	21 ,,	Total	13,614 lineal yards = 7 miles 1294 yards

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GAS-METER TESTING AT MANCHESTER.

Proposed Abolition of the Index Test.

At the Monthly Meeting of the Manchester City Council to-morrow (Wednesday), a resolution will be submitted by the Gas Committee that after March 31 the testing of indices of gas-meters shall be discontinued. The resolution adds that in future the Committee will simply comply with the requirements of the Sales of Gas Act in regard to the testing and stamping of meters.

The present system of testing meters was introduced in July, 1901, as a result of a conference between the City Justices' Gas-Meter Testing Committee, the Corporation Gas Committee, and certain manufacturers of meters. The test is a "double" one—the index and drum being tested separately, and certified as correct, before the meter is issued as a completed instrument. It is declared that hundreds of pounds have been saved to the Corporation, as well as to the ratepayers of the city, by this test. The charge made by the Testing Committee has averaged 4d. per meter; and the annual cost to the Corporation has been about £400. For this they have had the assurance that every meter tested was a perfect register of the quantity of gas passing through it.

The resolution of the Gas Committee was considered at a special meeting of the Manchester Justices' Gas-Meter Testing Committee on Friday; and it was stated that an effort had been made by the Justices' Committee to arrange a conference with the Gas Committee for the purpose of discussing the resolution. The Gas Committee, however, declined the invitation, considering that no good could come of such a conference, and holding out no hope of them changing their decision upon the matter. It was also stated that a further meeting of the Gas Committee had confirmed the resolution. It was eventually decided, however, that the Gas Committee be again approached with a view to the resolution being withdrawn.

A member of the Justices' Committee confessed that he could not at all understand the attitude of the Gas Committee, but he hoped that a conference would take place between the Committees before the matter was pursued further. He pointed out that the cost of testing the meters was very small every year. It was true, he added, that very few indices were found to be incorrect; but this, he claimed, was because manufacturers had found that it was highly desirable that they should make as accurate an article as possible. Manufacturers, in fact, tested the indices before the meters were allowed to leave the works. Of the few meters that had been found to be inaccurate, however, nearly every one was in favour of the Corporation and against the consumer; and the extent to which the meters were inaccurate ranged between 20 and 120 per cent. This was a matter of great importance to the consumer as well as to the Gas Department, for surely it was not in the interests of the latter to have a dissatisfied consumer. The consumer, he added, was surely entitled to have the index tested before the meter was connected up to his fittings. The Gas Committee ought, in his opinion, to see that, as far as possible, the meters they sent out were perfect instruments of measurement.

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Thirsk Gas Company.—At the annual meeting last Wednesday, dividends of 4½ per cent. on the original capital and 3½ per cent. on the additional capital, less income-tax, were declared for the half year, making 8½ and 7 per cent. respectively for the year.

TOWN GAS AND BENZOL SUPPLY.

Writing in the "Westminster Gazette" on Tuesday of last week a correspondent, signing himself "J. O.," dealt with this subject as affecting motors and motoring.

He said: When Mr. W. J. A. Butterfield read an address at Cardiff in the spring of last year, on "The Products of Coal Distillation," he dwelt upon benzol recovery, which interests us greatly now that the Government has adopted the novel expedient of stripping town gas and the gas obtained from coke-ovens for benzol, in order to extract from it the 10 to 25 per cent. of toluene, a constituent of the high explosive known as trinitrotoluene. It is, of course, regrettable in many ways that the widening scope of the war has compelled this drastic action; but, since it has been taken, it encourages one to seek all the information available in order to ascertain how this virtue of necessity will react on the petrol situation when peace comes. Mr. Butterfield has not overlooked this point; and we are indebted to him for data on the subject which are most valuable in placing the matter in its right perspective. When Mr. H. L. Doherty, of New York, in May, 1913, advocated before a meeting of experts at the Savoy Hotel the complete or partial extraction of benzol from town-gas supplies, in the belief that the extracted benzol would be of more service to the community for use as motor spirit than the benzol vapours in gas would be to gas consumers, neither he nor his audience had any notion that, little more than two years after, the whole of the gas plants in the kingdom would be nationalized for that very purpose.

And the fact that the gas plants are nationalized in this way makes one wonder whether the recovery processes installed will be permanent or not. If they are to be retained, then benzol will go a long way to relieve a situation which has been steadily hardening, till, as the result of a protracted war, it threatens to break. At present we can only sympathize to some extent with the oil companies who find it difficult to meet the requirements of the Army and Navy and keep up their supplies to private users. But we cannot be expected to forget the experiences of the past, and the uncertainty in the matter of prices. As Mr. Butterfield puts it, the plant for the extraction of toluene now being employed in many gas-works may be utilized to test the practicability of Mr. Doherty's proposal, and with some modification of its working may continue to be of service after peace has been declared. Broadly speaking, Mr. Butterfield explains that coal gas contains about 1 per cent. by volume of vapour of benzene, toluene, &c., and that if all this is extracted there are obtained about 2·25 gallons of crude benzol per ton of coal carbonized—this being the average with different classes of coal treated at different temperatures, in various forms of retorts.

And this is the point of interest to gas consumers—that the removal of all the benzol from coal gas should effect a reduction of only about 7 per cent. in the calorific power of the gas. The debenzolized gas would give practically no light with open-flame burners, though the light from incandescent burners would be affected only to a small extent. But it has been ascertained by practical trial, the author says, that at least one-third of the benzol content of coal gas, as produced in gas-works at the present day, can be extracted from the gas without reducing its calorific power below the standard of 500 B.Th.U. per cubic foot—a figure, be it noted, which conforms to the trend of recent legislation in regard to the quality of town gas, and which gives as much light with open-flame burners as is required for the uses for which they are still retained.

Hence, in Mr. Butterfield's opinion, if there is a suitable market, as we have reason to believe there is, for the extracted benzol, it would appear to be economically politic that this one-third of benzol should be taken away before the distribution of the gas to consumers. This would give a total yield in the carbonization of 16,052,487 tons of coal (1912) by the whole of the gas-works in the United Kingdom of 12,000,000 gallons of benzol. But the possible supply from coke-ovens, if the whole of the gas produced in them were debenzolized in recovery plant, would amount, on the basis of the output of coke in the United Kingdom in 1913, to about 60,000,000 gallons. This is independent of the comparatively small quantities of benzol obtained from the distillation of coal tar, which Mr. Butterfield says goes far towards meeting the present demand for benzol for chemical manufactures in this country. The consumption in the United Kingdom prior to the outbreak of war was at the rate of 130,000,000 gallons per annum, and was rapidly increasing; and he thinks the greater part of the possible output of benzol, from the complete stripping of coke-oven gas and partial stripping of town gas, might be regarded for the time being as available for motor spirit in competition with imported petrol. From this it will be seen that we have the means (presumably in full operation now) of supplying more than half the motor spirit required, not to mention the perceptible increase due to its higher thermal value.

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Matlock and District Gas Company.—One of the Directors of the Company having resigned, the remaining members of the Board have had under consideration the question of filling up the vacancy, and have come to the conclusion that "at the present time it is not necessary to take this step." The accounts for the year ended Dec. 31 show a disposable balance of £6946; and after the payment of a dividend at the rate of 7s. per share on the paid-up capital of the Company for the past six months, there will be a carry-forward of £5062.

City of Chichester Gas Company.—The half-yearly meeting of the Company will take place at Chichester to-day, when the Directors will submit a report and accounts setting forth that the balance standing to the credit of the profit and loss account, net revenue (after providing for interest on the debenture stock, temporary loans, &c.), amounts to £1704, out of which they recommend the declaration of a dividend for the half year ended Dec. 31 at the rate of 7 per cent. per annum upon the "A" capital stock and £4 18s. per cent. per annum upon the "B" and "C" capital stocks, all less income-tax. The continued increase in the cost of coal and other materials, together with the decrease in the quantity of gas sold, due to the further lighting restrictions enforced by the military authorities, compelled the Directors to make another increase of 4d. per 1000 cubic feet in the price of gas from Oct. 1 last.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Feb.* 28.

There is nothing new to report in the tar products market, and values generally remain unaltered.

In sulphate of ammonia, the demand for the home market continues. The export position is without change; everything being dependent upon the granting of further licences. The quotation is still £17 5s. per ton, net, into buyers' bags, at makers' works, for 25 per cent. quality.

Tar Products in the Provinces.

Feb. 28.

There is no alteration in the markets for tar products. Very little business is being done in pitch. Creosote is still weak, and fair quantities are offering at reasonable prices. Solvent and heavy naphthas are in great demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 16s. 9d. to 20s. 9d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. to 2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2½d. to 2⅝d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

⁂ Through a clerical error, the quotation in the "JOURNAL" of the 1st inst. for coal tar crude naphtha and heavy oils was given as 6¾d. to 7d. and 3⅞d. to 4⅛d. respectively. The price should have been 6½d. to 7d. and 3⅞d. to 4d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Feb.* 26.

There has been more business doing during the week, but supplies have been fairly plentiful, and there has been no alteration in values. The closing quotations are £16 17s. 6d. per ton f.o.b. Hull, £17 per ton f.o.b. Liverpool, and £17 5s. per ton f.o.b. Leith. There has been some second-hand selling in the forward position at a moderate premium on spot prices, but producers still remain aloof in the hope of a distinct recovery in values all round.

Nitrate of Soda.

This market is firmer again, and holders on spot now require 16s. 10½d. per cwt. for ordinary quality, and 17s. 6d. for refined.

Sulphate of Ammonia.

From another source, it is stated that the following are the prices for sulphate of ammonia. Outside London makes, £16 10s.; Hull, £17; Liverpool, £17 2s. 6d. to £17 5s.; Leith, £17 5s.; Middlesbrough, £17 2s. 6d. to £17 5s.

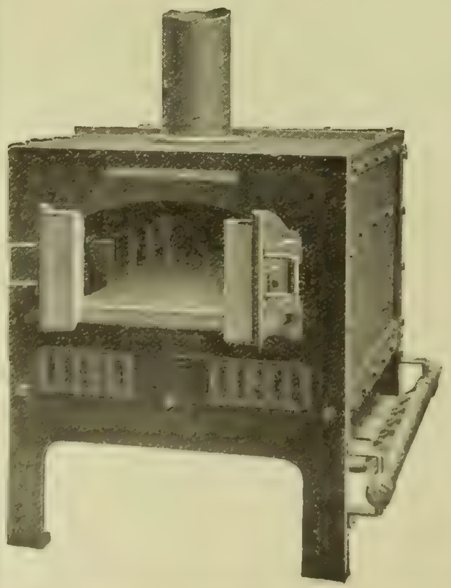
COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is active; but the shipments are in some measure limited by the lack of ready steamers, and by the delays that have arisen in the stormy weather. In the steam coal trade, there is a very good demand, with prices firm, especially for prompt loading; and where this is obtainable, some of the collieries will pay well for tonnage. Best Northumbrian steams are variable in quotation—from 31s. to 34s. per ton, f.o.b, according to the time of delivery. Second-class steams are from 29s. 6d. to 32s. per ton, with a strong inquiry; and for steam smalls about 15s. to 17s. per ton is quoted, according to the class. The demand for fuel from Sweden for the season seems now to be setting in for steam smalls. In the gas coal trade, the inquiry is good; but the lack of tonnage is in some cases delaying shipments. Best Durham coal is quoted 25s. to 26s. per ton f.o.b.; for second-class gas coal about 24s. per ton is the price; and "Wear Specials" are 27s. per ton f.o.b. The high freights are still a factor in the gas coal trade for abroad, accompanied as they are by delay at some of the discharging ports. For Genoa, 86s. has again been paid for freight, and Tyne to Rouen is at 33s. With the cost of the sea-carriage so high, there is only cautious commitments for forward sales; but exports have been limited so far this year, and business on the season's foreign contracts ought in the usual course to be needful soon. In coke the demand is good, and values do not seem to be much changed. Good gas coke is steady at 29s. to 29s. 6d. per ton f.o.b.

British Gas Light Company, Limited.—The Directors of this Company will, at the half-yearly general meeting to be held this week, recommend (subject to audit) a dividend at the rate of 10 per cent. per annum, with a bonus of 2s. 6d. per share, for the half year ended Dec. 31, both less income-tax, and payable in April.

Adverse Conditions at Cleveland.—At the half-yearly meeting of the Cleveland Gas Company, last Wednesday, the Directors expressed regret that the results of the working had not been more satisfactory. The operations had been adversely affected by the high price of coal, by the lessened consumption of gas under war conditions, and by the competition of electricity. The sum of £778 had been expended on the renewal of retorts, &c., and charged to revenue; and £400 had been transferred from the contingent fund, which allowed £190 to be carried forward. The report was adopted.



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Grays and Tilbury Gas Company.

The Chairman, Major Bartlett (T.D.), being engaged in the fighting line in command of his battery, the recent half-yearly meeting of the Company was presided over by Mr. Courtenay Fooks (the Deputy-Chairman), who pointed out that the gross revenue from sales of gas had increased from £14,603 to £16,251, and the returns from residuals from £2305 to £2530. The gross revenue for the six months was £18,787, compared with £16,928, which the Board considered highly satisfactory, having regard to the lighting restrictions. As was to be expected, the cost of production had largely increased. The net result was a profit of £5595, which was more than sufficient to pay the usual dividends. The statistics for the past year provided by the Manager (Mr. A. W. Sumner) showed that there had been a steady increase in the demand for gas; the total quantity made amounting to 153,452,000 cubic feet, which was an increase of 7·84 per cent. over the preceding year. Suitable provision was made in the accounts for dependants of employees serving in the Army. He thought the position of the Company would bear favourable comparison with that of any other gas undertaking of equal dimensions and operating under similar conditions. The dividends declared for the half year were at the rates of 8½ and £5 19s. per cent., less income-tax, on the "A" and "B" shares respectively.

◆

Barnstaple Gas Company.—The annual meeting of the Barnstaple Gas Company was held last Saturday week, Mr. C. E. R. Chanter presiding. The report stated that the amount standing to the credit of profit and loss account was £2294; and it was proposed to declare a dividend of 5 per cent. on the "A" shares and 3½ per cent. on the "B" shares, making a total of 10 and 7 per cent. respectively for the year. The Chairman said the income for the year had been £10,905, compared with £10,814 in 1914; and the expenditure £9205 and £8158 respectively. The enormous increase in freights continued to be nothing short of a scandal. The price of gas had to be increased; but the receipts from the sale of gas yielded very little more than in 1914. The report was adopted.

East Grinstead Gas and Water Company.—It was reported at the annual meeting of the Company that the receipts from sales of gas in 1915 were £8685, as compared with £8320 in 1914; from residuals £3021, against £2495; and from water £4215, against £3980. These figures showed a total increase of £1126 in receipts over those of the previous year. In consequence of the rise in the price of coal, the Directors were reluctantly compelled at the end of the June quarter to raise the price of gas 4d. per 1000 cubic feet. The accounts showed an available balance of £8936, from which the Directors recommended dividends of 9 per cent. on the "A" stock and "A" shares, and £6 6s. per cent. on the "B" and "C" shares (less income-tax). Interim dividends of 3½ and 2½ per cent. were paid in September last, so that 5½ and £3 16s. per cent. will be payable now. This will absorb £2735, and leave a balance of £6201 to carry forward.

Basis of Water-Rates at Woking.

As was recorded in the "JOURNAL" at the time,* the Woking Water and Gas Company have been involved in litigation with a consumer, who took proceedings before the Justices for the purpose of establishing his contention that the water-rates levied by the Company should be based upon the rateable value, instead of upon the gross estimated annual rental of his premises. The Justices gave a decision in his favour; and the Company thereupon made application for a case to be stated for the decision of the High Court. The Divisional Court unanimously reversed the finding of the Justices, and decided that the rate was payable upon the gross estimated annual rental. Stating these facts in their half-yearly report, the Directors say that this result was in accordance with opinions previously obtained by the Company from Sir R. B. Finlay, K.C., M.P., Mr. J. H. Balfour-Browne, K.C., and Mr. A. Clavell Salter, K.C., M.P.; the latter of whom most ably argued the case for the Company. An appeal was lodged against the judgment of the Divisional Court; but it has now been abandoned. As to the business of the Company during the six months ended Dec. 31, the Directors point out that, after meeting the usual charges for interest, and transferring the sum of £1000 to the contingency fund, there remains a balance at the credit of profit and loss account of £7880, out of which they recommend the payment of a dividend at the rate of 6 per cent. per annum for the past half year (less income-tax), which, together with the income-tax thereon, will absorb £5047, and leave £2833 to be carried forward. During the half year, 31 additional house and 13 meter connections were made. The service-mains have been extended about 4781 yards.

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* See "JOURNAL," Vol. CXXI., p. 85; Vol. CXXXII., p. 651.

◆

Big Increase in Consumption at Crowborough.—Presiding at the seventeenth annual meeting of the Crowborough District Gas Company, Mr. Andrew Dougall pointed out that the Board were in the gratifying position of being able to report an increase of 14½ per cent. in the sales of gas. The revenue for the year was £1849, which with the amount brought forward made a total of £4412. After deducting debenture interest, &c., and paying a dividend of 3 per cent. per annum, there is a carry-forward of £2792.

Gas Supply at Seaham Harbour.—At the annual meeting of the Seaham Gas and Lighting Company last Tuesday, dividends were declared of 8 per cent. per annum on the "A" stock and "B" shares, 6 per cent. on the "C" stock, and 4½ per cent. on the preference stock, all less income-tax. This will absorb £1070, and leave £5495 to be carried forward. The Directors reported that the make of gas during the year had been 71,898,000 cubic feet, a decrease of 2,973,000 feet when compared with 1914. A profit of £2787 was realized; and exclusive of mortgage interest and the interim dividend paid up to June 30, £6566 was available for final dividend.

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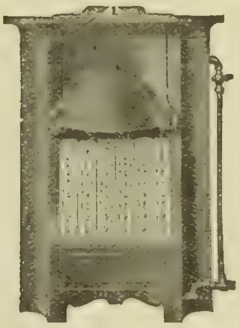

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Gas Supply of Perth (W.A.).

Last year was a satisfactory period for the municipal gas-works at Perth (Western Australia); there having been an increase of 4¾ per cent. in the quantity of gas manufactured. Reporting upon the operations, the Manager (Mr. James Andrew) stated that the average quantity of coal gas made per ton was 12,440 cubic feet, which compares with 12,237 feet in the preceding year. The total number of meters fixed on Oct. 31 last was 3372 (of which 1392 were of the prepayment type); the increase on the year being 600, or 21·64 per cent. During the twelve months, 3680 yards of main were laid; but there was, owing to the war, great delay in the work of erecting a new holder at East Perth. Concluding his report, Mr. Andrew says that the output of gas has not increased in the same proportion as the number of connections, owing to many business places changing from gas to electric lighting, while new gas connections are for cooking purposes mainly. The additional storage space will enable the present gas generating plant to be worked to better advantage, and will permit of a somewhat increased output, but will not, until the capacity of the generating plant is enlarged, enable the service to be greatly extended. On this account, and partly because of shortage of material, stoves, meters, &c., it is unfortunately impossible to accommodate many present applicants for connections.

Rowley Regis and Blackheath Gas Company.—The annual meeting of the Company was held last Thursday, under the presidency of Mr. D. Fellows. The report stated that the balance of the profit and loss account was £937; and the Directors recommended a dividend of 6 per cent. on the "A" shares and £4 4s. per cent. on the "B" shares. The Chairman called attention to the increased sales of gas, which had been principally in the direction of supplies to manufacturers; and he further referred to the great loss of gas that had been caused through leakage, due to active mining operations in the district. The report was approved.

Guiseley Water-Works Purchase.—The Guiseley Urban District Council and the Water Company have come to an agreement, under which the latter will transfer to the Council the whole of their undertaking for the sum of £16,000 (at the rate of £2 per £1 capital), *plus* the present and any further outlay on a bore-hole which is now being made—the sum named not to include the accumulated funds of the Company. The agreement is subject to the approval of the Local Government Board; and the purchase is to be completed within a period of twelve months immediately following the termination of the war, or, if the Yeadon Water Company refuse to transfer an agreement at present existing between them and the Guiseley Company, at the expiration of such agreement. Meanwhile, the Guiseley Company will carry on their undertaking as at present. In view of this agreement, it is thought the Guiseley Council will now probably oppose the Bill which the Yeadon Water Company are promoting in the present session of Parliament to bring Guiseley into their area of supply.

Hartlepool Gas and Water Company.

The annual meeting of the Company was held last Thursday, when the report submitted showed that the revenue for the year was £89,334, and the expenditure, including interest on loans, &c., £63,478, leaving a balance of £25,856 as profit for the year. An interim dividend was paid in September last, and the Directors now recommended the payment of a dividend for the last half year at the rate of 5 per cent. per annum, less income-tax. Repairs at the works consequent on the damage from the bombardment by German warships, had been practically completed; and the cost had been refunded by the Government. The works were now fully insured against bombardment and aircraft risks. Last May the Board decided to raise the price of gas to ordinary consumers 4d. per 1000 cubic feet, to partially meet the increased cost of labour, coal, and other materials. The report added that, in anticipation of a further shortage of labour, and with the effect also of reducing the cost of gas manufacture, a contract had been entered into for the supply and erection of modern stoking machinery, with coal and coke handling plant. It was hoped to have this in operation before next winter. The Directors referred with deep regret to the death of Mr. Thomas Bower, the Consulting Engineer and late Engineer and General Manager of the Company. The Chairman (Mr. O. H. Trechmann), in moving the adoption of the report, said the war pressed on a company like theirs, as, on account of the danger from sea and air, the town had to remain practically in darkness; and this, along with the general economy which was urged upon everyone, was reducing the consumption of gas very considerably. The revenue from gas was £2830 less than during the previous year. The decrease in the sale of residuals was £1493, and in water £1003. These three sums made a decrease in the revenue of £5326. On the other hand, they had an increase in the cost of coal and oil of £3289, bringing the adverse balance to £8615. The report was adopted.

Progress at Redhill.—The Directors of the Redhill Gas Company were in the position of being able to report at the annual meeting that sales of gas in 1915 had exceeded those of the previous year by 13 per cent. Higher costs had, however, necessitated, as elsewhere, an increase in the price of gas; and this reduced the standard rate of dividend payable to 9½ per cent. on the share capital and 4¾ per cent. on the "B" stock. These dividends, less income-tax, were declared, leaving a balance of £1024 to be carried forward. A vacancy on the Board caused by death, it was decided should not be filled—a suggestion of the Directors that their remuneration should be reduced accordingly, being agreed to. The Chairman (Mr. G. R. Hunt) spoke of the loyalty of the whole of the staff and employees during the difficult times through which they were passing—entailing much unusual and strenuous work—and the patriotism shown by a considerable proportion of their regular men, who were at the present time on active service, and whose places with the Company were being kept open for them.

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Weardale and Consett Water Company.

Moving the adoption of the report and balance-sheet at the annual meeting of the Company on Monday of last week, Mr. A. F. Pease said the revenue during the past year had been £94,010, an increase of £531; and the working expenses had totalled £31,969, a decrease of £8553. The surplus revenue was £62,040, a total increase of £9084. Incidental expenses had advanced by 9 per cent., wages by 10·36 per cent., and rates by 28·76 per cent. Of the 160 employees, 21 had enlisted and 46 attested. They were receiving splendid support from the men left behind. For the first time for many years, there would be a slight reduction in the dividend. They worked up from a small dividend to one of 7 per cent., and now they had to recommend 6½ per cent. The report was adopted.

Corporations and Public Lighting Contracts.—Attention was called, at a meeting of the Council of the Association of Municipal Corporations, to the recently reported case of the *Leiston Gas Company v. Leiston-cum-Sizewell Urban District Council;* and the matter was referred to the Law Committee for consideration, with instructions and authority to take such steps on behalf of the Association as may be deemed advisable in the interests of boroughs which are parties to similar agreements, including (if practicable) an appeal against the decision in the case referred to. This decision was, of course, in favour of the Gas Company.

Southgate and District Gas Company.—The report of the Directors for the final six months of 1915 states that, compared with the half year ended Dec 31, 1914, there has been a reduction in the sale of gas of 3,420,400 cubic feet, or 3 per cent., and an increase of £752 in the revenue from residual products. After providing for interest charges, &c., there remains a balance of profit of £5132. The Directors recommend the declaration of dividends for the half year at the maximum rates of 5 per cent. per annum on the preference capital, of 10 per cent. per annum on the original capital, and 7 per cent. per annum on the additional capital. This appropriation will require the sum of £4325, and leave a balance of £807 to the credit of the profit and loss account to be carried forward to the current half year.

Smethwick and Female Labour.—At a meeting of the Smethwick Town Council last Tuesday, the Gas Committee reported the receipt of a letter from the Master of the Royal Mint requesting the clearance of automatic gas-meters at more frequent intervals than at present, with a view to the coins being returned into active circulation as speedily as possible. The Committee decided to give a trial to the employment of women for this work. They further reported that they had had under consideration the question of the employment of female labour at the gas-works, and they had instructed the Engineer (Mr. Vincent Hughes) to engage a number of women in connection with breeze screening or such other work as may be found useful. A mess-room for their accommodation had been provided.

Cheltenham Gas Company.

The Directors of the Cheltenham Gas Company, in their annual report, state that the balance standing to the credit of the profit and loss account enables them to recommend the payment of the maximum statutory dividend at the rate of 5 per cent. per annum (less income-tax) for the half year ended Dec. 31 upon the paid-up consolidated ordinary stock of the Company. The revenue account for the past twelve months compares favourably with that of the preceding year. In consequence of the increase in wages and the cost of coal, the Directors have, however, been obliged to raise the price of gas to the consumer; and the change now stands at 2s. 9d. per 1000 cubic feet. To provide for the further extensions of the business, the Directors in May last, with the consent of the Treasury, raised a sum of £5001, by the issue of £4900 of 5 per cent. consolidated ordinary stock, yielding a total premium of £101. From the revenue account, it appears the amount of gas sold to private consumers was 467,255,000 cubic feet, or 9,390,400 feet more than in the previous year, and that income from this source was £51,781, as compared with £46,087. The difference is partly accounted for by the fact that the price of gas, which was 2s. 1d. in 1914, was raised to 2s. 3d. in March last, and to 2s. 9d. later in the year. The total revenue from the sale of gas was £59,099, as compared with £53,291, or an increase of £5808. The amount carried to profit and loss account is £15,232, as against £13,021 the previous year.

Whitby Gas Company.—At the annual meeting of the Whitby Gas Company, Mr. Freeman Richardson, who presided, announced that the increased severity of the lighting restrictions and the paucity of summer visitors accounted for the receipts being £1152 less than in the previous year. The expenditure had, however, been reduced by £1199, and £2090 was carried forward. Dividends were declared at the rate of 3 per cent. on the original capital, and of £2 2s. per cent. on the additional and new additional capital, for the half year ended Dec. 31, 1915, making, with the interim dividends, 6 per cent. on the original capital and £4 4s. per cent. on the additional and the new additional capital for the year.

Mond Gas in South Staffordshire.—The regret of the Board that they had not been able to get a better return for the strenuous efforts made and the hard work done, was expressed by Mr. R. L. Mond, when presiding at the meeting of the South Staffordshire Mond Gas (Power and Heating) Company. He pointed out that, in addition to the rise in the price of coal, there had been great deterioration in the quality of the fuels obtainable which had adversely affected the output of gas and residuals, and also caused increased labour and expense in handling. Out of a sum available of £9926, it was decided to pay a dividend of 6 per cent. on the preference shares, and to carry forward £4976. The Board did not feel justified in recommending a dividend on the ordinary shares. The Company are now supplying 164 works, or five more than a year ago.

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Otley's Prosperous Gas Undertaking.

A correspondent writing to the "Yorkshire Observer" says: Even the least avaricious of Otley's ratepayers must occasionally cast covetous eyes at the profits of the Otley Gas Company. Beginning about seventy years ago with a capital of £4000, the Company have never failed to increase in prosperity; and the profits reported at the annual meeting total £4162. They are too large, in fact, for immediate disposal; the regulations only permitting, in this case, a dividend of 5½ per cent. Consequently, the carry-forward item is increased from £10.423 to £11,442. A matter for regret is the fact that the balance is partly due to an increase of 6d. per 1000 cubic feet in the cost of gas to the consumer; the price having been raised last June from 2s. 8d. to 3s. 2d. It is now eleven years since Otley seriously considered the question of purchasing, and decided, first by a ratepayers' meeting and then by a poll, not to do so. The Chairman at that time of the Otley District Council (Mr. Edward Greaves) gave the purchase price as "less than £100,000;" and some of the leading opponents to the proposed purchase said they would be in favour of taking over the gas-works if they thought a profit of £800 a year could be made. What can their opinion be now, when they ponder over the fact that the yearly profits during the last five years have averaged £4000? Assuming that the District Council could manage the gas production business as well as the Company's Directors do, it would have meant 2s. in the pound less on the district rate, and probably a little more when the necessary loan had been paid off.

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Westminster Public Lighting.—Alderman Tallents (the Chairman of the Finance Committee), in presenting the estimates for the current year to the Westminster City Council, remarked that it appeared that a reduction of £3600 would be effected in gas lighting during the coming year, owing to the new contract entered into. The Works Committee anticipated a reduction of £500 under the head of electric lighting; but he failed to see how this was arrived at, as electric light was dearer. The estimate for gas amounted to £9400, and for electric light to £23,000.

Wolverhampton Gas Company.—The report of the Directors for the half year ended Dec. 31 states that there is a net profit of £9215. This, added to the balance brought forward, enables the Directors to recommend payment of dividends as follows: 3 per cent. upon the preference stock, 5 per cent. upon the consolidated stock, and 3 per cent. upon the new ordinary stock, less income-tax. The increase in the price of gas from 2s. 6d. to 2s. 9d. per 1000 cubic feet reduces, by reason of the operation of the sliding-scale, the dividends on the consolidated and new ordinary stocks to 5 and 3 per cent. respectively. The Directors further recommend that £464, interest for the half year, be placed to the credit of the reserve fund, and £59, like interest, to the credit of the insurance fund; and that the balance of £31,725 be carried forward to the next account.

Bishop's Stortford, Harlow, and Epping Gas and Electricity Company.

At the tenth half-yearly meeting of the Company last Wednesday, accounts were submitted for the six months ended Dec. 31. The Directors reported that, compared with the corresponding period of the previous year, the sale of gas had increased by 886,100 cubic feet, or 1·3 per cent., and the income derived from residual products by £337. The balance to the credit of the revenue account for the half year was £3782. After charging £519 for interest, income-tax, &c., an amount of £3263 was added to the profit and loss account, which, with £33 brought forward from the previous half year, made the balance available for the payment of dividends £3296. The Directors accordingly recommended the declaration of dividends for the six months ended Dec. 31 at the statutory rates. The payment of these will require the sum of £3249; and leave a balance of £47 to the credit of the profit and loss account to be carried forward. During the half year there was a continued advance in the extraordinary war prices of coal and other materials required for carrying on the Company's undertaking. The drastic curtailment of the public lighting, and the complete cessation of outside and shop lighting imposed by the military and police authorities, also seriously affected the Company's business. If these unfavourable conditions continue without amelioration, a further increase in the price of gas will become inevitable. In connection with the electricity undertaking, a canvass of the householders and tradesmen in the compulsory area had been made; but, as a result of the general feeling of uncertainty due to the war, only seven or eight applications for a supply of electricity were received. The Directors therefore decided to postpone the supply of current until financial and general conditions become more favourable.

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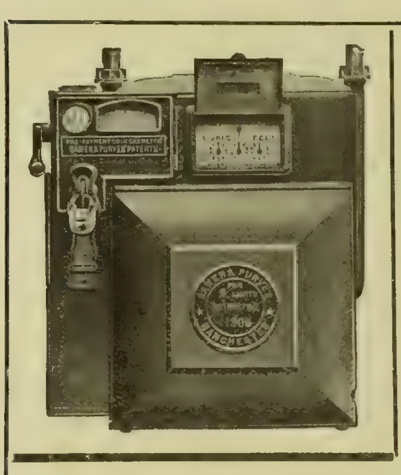
Electric-Lighting Contract and the Restrictions.—The public electric lamps at Barton-on-Humber have not, owing to the lighting restrictions, been in use for a long time; and when the Electric Supply Company sent in a bill for £140 for a half-year's lighting the Urban District Council offered to pay 50 per cent. of the amount. The Company refused this, and demanded 90 per cent., threatening proceedings. At a special meeting of the Council last Thursday night, it was decided to appeal to the Local Government Board for advice, and to ask that legislation be introduced to deal with such cases.

Bangor (Co. Down) Gas Extension.—In connection with the application of the Bangor Urban Council for a Provisional Order to acquire lands for the manufacture and storage of gas and gas-manufacturing materials in extension of the present works, a suggestion by the Local Government Board's Chief Engineering Inspector (Mr. P. C. Cowan) was adopted, and an arrangement made for taking over, under an agreement, property belonging to Messrs. R. Neill and Sons and Mr. James Fletcher. The Inspector has intimated that he will recommend the granting of the Order for gas making and storage.



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A Steadily Growing Demand at Chester.

The Directors of the Chester United Gas Company were able to report at last week's meeting that the receipts from gas for the half year ended Dec. 31 were considerably larger, owing to the increased price, and also to the greater quantity supplied; there having been a steadily growing demand throughout the year for gas for domestic and industrial appliances. Difficulties had naturally arisen, owing to the continued absence of a valuable contingent of the Company's regular employees; but those who remained had in nearly all instances loyally assisted in overcoming obstacles and in maintaining a satisfactory supply of gas. The condition of the works and mains had been well maintained; but the Directors regretted they had felt compelled to abandon for the present the provision of additional storage accommodation referred to in their report twelve months ago. The balance to the credit of the profit and loss account, after providing for payment of interest on the debenture stock and dividend on the preference stock, was £3990; and the Directors recommended the payment of a dividend on the ordinary stock in respect of the half year ended Dec. 31 at the rate of 2½ per cent., which, with the interim dividend, would make up the maximum rate of 5 per cent. for the year. The Mayor (Alderman J. M. Frost), who is Chairman of the Company, pointed out that the profit of the past half year was sufficient to pay interest charges and the usual dividends. They might congratulate themselves on this result; and he wished to express, on behalf of the Board, their appreciation of the fidelity and constancy with which the diminished staff and the regular employees of the Company, more particularly those of long service, had uniformly carried out their duties, often under the most difficult and disheartening circumstances.

◆

Brighton and Hove General Gas Company.—At the meeting of the Company next Friday, the Directors will report that, compared with the half year ended Dec. 31, 1914, the sale of gas in the last six months has increased by 17,871,000 cubic feet, or 2·49 per cent., and the revenue from residual products by £4749. The profits, including £31 received for interest, amount to £30,935, to which is added £36,614 brought forward from the previous half year, giving a total of £67,549. After charging interest, income-tax, &c., a sum of £63,905 is available; and the Directors recommend the declaration of dividends for the six months at the statutory rates of 6 per cent. per annum on the "B" preference consolidated stock, 4 per cent. per annum on the "C" preference stock, 10¾ per cent. per annum on the original ordinary consolidated stock, and 7¾ per cent. per annum on the "A" ordinary consolidated stock. This appropriation requires the sum of £22,705, and leaves a balance of £41,200 to be carried to the credit of the profit and loss account for the current half year. Mr. Joseph Cash, M.Inst.C.E., having retired from the office of Engineer and General Manager, has been elected a member of the Board. The Directors hope in this new capacity Mr. Cash's valued services to the Company may be continued for many years.

Construction Work at Longwood.

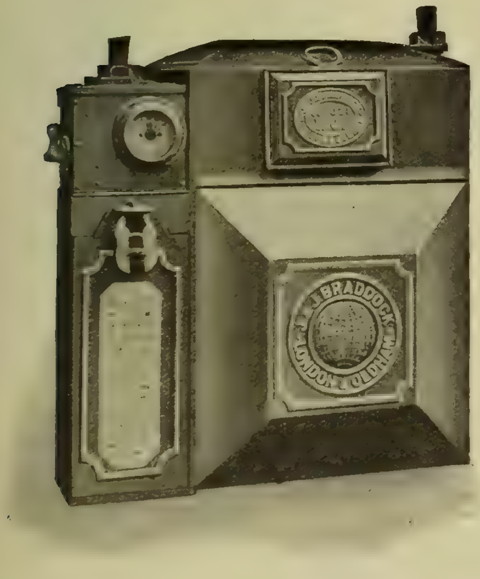
In their report to the stockholders for the year 1915, presented at the meeting last Thursday, the Directors of the Longwood and Slaithwaite Gas Company stated that, in consequence of the high cost of production, the Directors advanced the price of gas from March 31 by 3d. per 1000 cubic feet. It was subsequently realized that the advance was totally inadequate to meet the increased cost of coal and other materials and labour; and a further advance of 3d. was consequently made on Sept. 30. These advances still fell short of meeting the extraordinary expenditure caused by the prevailing conditions. Under the operations of the sliding-scale, the higher price of gas reduced the amount of dividend divisible by 2s. 6d. for each penny advanced. As foreshadowed in the last annual report, the Directors had placed contracts for new manufacturing plant on the vertical retort system. Though the contracts were placed in February, labour and other difficulties had interfered with the progress of the work. It was stipulated that the works should be ready by Dec. 1; but they are still far from complete. Everything possible was being done to expedite them. A new 6-inch main had been laid to the Slaithwaite works, for the purpose of conveying gas at high pressure to Slaithwaite when the new works were ready. The amount expended on capital account during the year was £11,867. The quantity of gas sold was 192,028,600 cubic feet, an increase of 14,743,500 cubic feet upon the combined output of the two amalgamated companies in 1914, or 8·31 per cent. A dividend at the standard rate of £2 11s. 3d. per cent. on the consolidated ordinary stock (Longwood) and at the rate of £2 6s. 3d. per cent. on the consolidated ordinary stock (Slaithwaite) was recommended for the December half year; being at the statutory rate. Dividends for the June half were paid at the rates of 2½ and 2¼ per cent. respectively.

◆

A Good Increase at Weston-super-Mare.—Sales of gas at Weston-super-Mare during 1915 showed an increase over the previous year of 17,790,700 cubic feet, or 7·75 per cent., which the Directors naturally consider to be extremely satisfactory. At the half-yearly meeting of the stockholders last Friday, they recommended the payment of the maximum dividend of 5 per cent. on the ordinary stock (less income-tax) for the six months ended Dec. 31.

Increased Sales at Bath.—There was an increase of more than 50 million cubic feet in the quantity of gas sold at Bath during the past year, notwithstanding a reduction in the supply for public lighting. In their annual report, the Directors stated that the great increase in the cost of coal under contracts made in the summer of 1915 rendered it necessary to raise the price of gas 2d. per 1000 cubic feet from the Midsummer quarter, to 2s. The depressed condition of the residual market referred to in the last report had changed to one of activity; and in the returns under this head some marked improvements appeared. An interim maximum dividend of 5 per cent. per annum, less income-tax, was paid for the half year to June 30, and the Directors recommended a similar dividend for the half year ended Dec. 31.

BRADDOCK'S PATENT "SLOT" METERS.



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Increase in the Price of Gas Cookers in Germany.—The combine of German Gas-Cooker Makers, at their general meeting on Jan. 20, decided to advance by 30 per cent. the price of gas-cookers, in place of the earlier advance of 25 per cent. The decision was to take effect at once, and was in consequence of the further exceptional increase in manufacturing costs.

Stamford Gas Company.—At the annual meeting of the Company the report showed that the profits admitted of a dividend of 8 per cent. upon the ordinary stock, which was declared. The dividend last year was ½ per cent. more; but, in accordance with the Company's Act, it is reduced, as the extra price of coal has compelled an increase in the rate charged by 3d. per 1000 cubic feet.

Price of Gas at Halifax.—After discussion, the Halifax Town Council have adopted the Gas Committee's recommendation of an alteration in the price of gas. The price is to be 2s. 6d. per 1000 cubic feet for lighting through ordinary meters, subject to the usual 5 per cent. discount. Prepayment meter consumers are to have returned to them 1d. for each 1s. paid into the meter (instead of 2d. as hitherto). For motive power, cooking, and heating stoves through separate meters, 2s. 3d. will be charged, subject to 5 per cent. discount. These changes come into force from March 31.

Falkirk Gas-Workers' Wages.—Mr. A. O. M. MacKenzie, Sheriff of Inverness, has now given his award as Arbitrator in a dispute between the Town Council of Falkirk and the employees in the retort-house at the gas-works, Falkirk. The men made an application for an increase of wages at the rate of 6d. per shift. The Council, however, argued that the men were as well paid as those engaged on similar work in other towns, and drew a distinction between hand-stoking and stoking by machinery, which is the method employed at Falkirk. The Sheriff has decided that the wages shall be raised by 3d. per shift—the advance to come into operation as from the beginning of the first full pay week from Dec. 15 last. It is to be regarded as war wages and recognized as due to, and dependent on, existing abnormal conditions.

Good Working at Tunbridge Wells.—When addressing the proprietors at the annual meeting of the Tunbridge Wells Gas Company, the Chairman (Alderman W. H. Delves) was in a position to inform them that there had been a higher production of gas per ton of coal carbonized. There had also been an increase of 19 million cubic feet in the quantity of gas sold; but this had practically all been in the first half of the year. Later, the lighting restrictions and the mild weather had affected them. He paid a handsome tribute to the work of Mr. C. F. Catt (the Secretary) and Mr. Andrew Dougall, M.Inst.C.E. (the Engineer and General Manager), who had greatly assisted the Directors during the anxious year just passed; and he expressed sympathy with the relatives of those employees who had lost their lives while fighting for the country. The report (which was adopted) stated that the profit and loss account, after paying an interim dividend and all fixed charges, showed a balance, including the amount brought forward, of £18,672, out of which the Directors recommended a dividend for the half year at the rates of 13 per cent. per annum on the consolidated ordinary stock, 10½ per cent. on the consolidated "B" stock, and 10 per cent. on the consolidated "C" and "D" stocks—leaving £13,197 to be carried forward. The great increase in the price of coal under war conditions had imposed a heavy burden upon the working; but the return to better figures for residuals had helped to relieve the strain. The Directors regretted that they were obliged to increase the price of gas 2d. per 1000 cubic feet as from Christmas last, making the price within the borough 2s. 8d.

Farnworth and Kearsley Gas Company.—At the half-yearly meeting of the Company, the Chairman (Mr. H. A. Barnes, M.A., J.P.), said the result of the six months financially speaking was identical with that of a year ago, when the balance carried forward to the profit and loss account was £2283. This time it was £2213, which implied a fairly accurate forecast on the part of the Directors, when they decided by what amount they should raise the price of gas. Everything they had bought had gone up in price; but fortunately the things they sold had advanced, which left them in the same position as before. Toluene was a substance required in high explosives; and since it could be readily extracted from the gas, the Government had applied to all fair-sized gas undertakings to extract it. They had done what they could in this matter; and though they were not paid for it, no one grudged any expense incurred to help the men in the trenches. Twelve months ago the works were insured against air-craft risks; and this insurance had been renewed. He called attention to the excellent portrait of their late Chairman, Alderman James Fletcher, J.P., which had been presented to the Company by the Misses Fletcher. The present lighting season was almost finished; and though the demands of the Army had taken 25 per cent. of the men engaged in the cotton industry, and would soon take far more, they had not yet suffered through lack of gas consumption. Personally, he was convinced there were bad times, commercially, before them; but it was certain their financial position, as a Company, was strong enough to stand a longer period of trade depression than he trusted might fall upon them. The report was adopted, and the maximum dividends of 10 and 7 per cent. were declared.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

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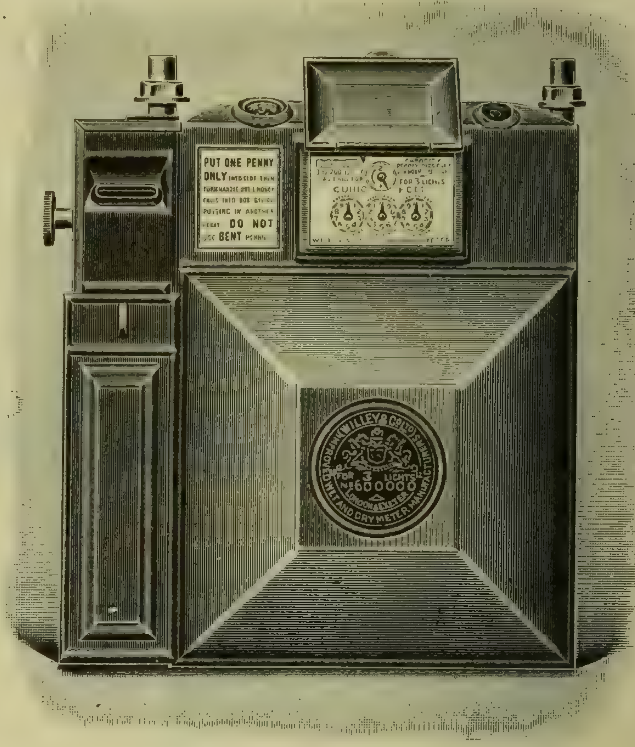

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The Halifax Corporation Gas Committee have appointed four women meter inspectors, at wages for the first six months of £1 1s. 1½d. per week of 39 hours, and after six months at £1 2s. 9d. per week. Only three women were advertised for; but there were 212 applications.

On Tuesday, the 14th prox., Messrs. A. & W. Richards will, by order of the Directors, offer for sale by auction, at the Mart, Tokenhouse Yard, E.C., such an amount of 4 per cent. consolidated preference stock in the Aldershot District Gas, Water, and Lighting Company as will realize a net sum of £10,401. The capital is required for further extensions; and the issue is sanctioned by the Treasury.

At last Thursday's meeting of the Westminster City Council, the Contracts Committee reported that they had considered tenders for the supply of coke for three, six, and twelve months. As several of the tenderers had, both on the present and on previous occasions, made their prices conditional upon the rise or fall of the gas companies, prices, the Committee thought it advisable to obtain supplies direct from the companies. The Gas Light and Coke Company offered to supply coke at current market rates, allowing the Council the rate of discount usually given to wholesale buyers—namely, 1s. 8d. per ton; and this offer the Council unanimously resolved to accept.

STOCK MARKET REPORT.

Business on the Stock Exchange last week was to a great extent of similar character to that of the week before. Generally speaking, it was decidedly quiet, and, without being exactly dull, there was rather an air of languor about it which arose perhaps from a disposition to "wait and see." Government issues were thus affected. In the early days of the week there was considerable buying of the War Loan, prompted by forecastings of an early issue of a new loan at a higher rate of interest, into which the existing loan would be convertible. But the forecast fizzled out, and so the War Loan fell back into its old position. Home Rails continued lacking in animation, with small variations either way. Americans were dull and inactive, in regard to which it must be borne in mind that the Government Dollar Mobilization Scheme has practically shorn the market of much of its business. Canadians could not wholly emancipate themselves from association with the market, despite fine traffics and prospects. In the Foreign Market, a noteworthy feature was the firmness of the French loan—a testimony to the calm confidence with which the country is meeting the desperate thrust of the Germans at Verdun. Japanese was also in demand, aided by the improved returns of foreign trade; and Russian was well regarded by the light of progressive successes in the Caucasus and Persia. *Per contra*, German Imperial 3 per cents fell to 42½, equivalent to a 7$\frac{1}{16}$ per cent. price for money—not encouraging for their next war loan. South Africans were weak. In the Miscellaneous group, some of the old favourites were not so uniformly buoyant, and oils, copper, and rubber were mostly on the down-grade, though the last mentioned steadied before the close. Topics of interest during the week have not been abundant, and were mainly associated with the machinations of the enemy to bolster up his decadent credit. Intrigues in regard to Argentine gold and Scandinavian liabilities aroused much discussion. Business in the Gas Market was more active, and the prices recorded indicate general firmness. It should be noted that several issues are now being quoted *ex div.*, and allowance should be made for the amounts thus deducted. In the Money Market, rates were steady generally.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 75, 75¾, South Metropolitan 75, 75¼, 75⅝, 76. On Tuesday, Gas Light ordinary 74½, 75, ditto debenture 60¾, Imperial Continental 64¼, 64¾, South Metropolitan 75½, 75¾, ditto debenture 60½. On Wednesday, Brentford "B" 84½, Gas Light ordinary 74¾, 75, ditto preference 74, 74½, ditto debenture 60¾, Primitiva 2⅛, South Metropolitan 75, 75¾. On Thursday, Brentford "B" 85, Commercial debenture 57, Gas Light ordinary 74, 74½, 75, ditto maximum 60½, ditto preference 74, 74½, 75, Imperial Continental 64¼, 64½, Newcastle 78, Primitiva 2$\frac{1}{16}$, ditto preference 3$\frac{9}{16}$, South Metropolitan 75, 75¼, 75⅝. On Friday, Commercial 4 per cent. 72, ditto debenture 56¾, Cape Town 1⅜, European 12⅜, 12$\frac{7}{16}$, Gas Light ordinary 73½, 74, 74¼, ditto preference 74¾, ditto debenture 60½, 60⅞, 61, Monte Video 8, 8¼, San Paulo preference 8$\frac{11}{16}$, South Metropolitan debenture 60½, 60⅝, 60⅞. On Saturday, Commercial 4 per cent. 72½, Gas Light ordinary 73½, ditto debenture 61, 61⅛, 61¼, Imperial Continental 63½, 63⅝, Monte Video 8⅜, Primitiva 2, 2⅛, South Metropolitan debenture 60$\frac{11}{16}$, 60⅞.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	5 18 2	..
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
333,110	10	,,	7	7/-	B 7 p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
731,930	,,	,,	†11	55/-	Do. New	204—209	5 5 8	84½—85*
55,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	1⅜
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	72—72½*
560,000	,,	,,	5⅛	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	56¾—57
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	5¾	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	12⅜—12$\frac{7}{16}$
16,327,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	73½—75¼*
2,600,000	,,	,,	3½	3½	3½ p.c. max.	76—79	4 8 7	60½*
4,062,235	,,	,,	4	4	4 p.c. Con. Pref.	96—99	4 0 10	74—75*
4,674,850	,,	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	60½—61¼
130,000	,,	,,	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7⅛	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	5⅞	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	63½—64¾
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
					B	146—148	4 14 7	
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	8—8⅜
1,875,892	Stk.	July 29	4½	4¼	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	78*
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4	2—2⅛
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4¾—5	5 0 0	3$\frac{9}{16}$
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	8$\frac{11}{16}$
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75—76*
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60½—60⅞
224,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	135—138	5 8 8	..
782,275	,,	,,	6	6	B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅞	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/3	55/1½	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

* Ex. Div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointment Vacant.

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Sale of Stock.

Aldershot Gas, &c., Company. London Mart. March 14.

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Sealed Tenders, duly endorsed, must be sent to the undersigned not later than Wednesday, the 15th day of March, 1916.

The lowest or any Tender not necessarily accepted.

JAS. H. ROTHWELL,
Town Clerk.

Municipal Offices,
Brighouse, February, 1916.

ABERTILLERY URBAN DISTRICT COUNCIL.

(GAS AND ELECTRICITY DEPARTMENTS.)

TENDERS are invited for the Supply of the whole or part of the Requirements of COAL of the above Departments during the Period of Twelve Months ending March 31, 1917.

Further Particulars may be obtained from the undersigned, to whom Tenders should be Delivered not later than March 9, 1916.

E. D. WOOTTEN,
Engineer and Manager.
Gas-Works, Abertillery, Mon.

BOROUGH OF DARWEN.

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Forms of Tender and all Information as to quantities may be obtained on Application to Mr. A. H. Smith, Gas Engineer, Darwen.

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No Tender necessarily accepted.

WILLIAM P. HALLIWELL,
Town Clerk.
Town Clerk's Office,
Darwen, Feb. 15, 1916.

JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST, LONDON.

VOL. CXXXIII., No. 2756.] TUESDAY, MARCH 7, 1916. [68TH YEAR.

EDITORIAL NOTES.

Price of Coal Act Interpretations.

THE Price of Coal (Limitation) Act has been the birthplace of a good deal of wrangling; and there has been a fresh outbreak in connection with the beginning of contract negotiations for the ensuing year. Two fresh points regarding interpretation have been raised; and on both Sir Thomas Ratcliffe Ellis, the Secretary of the Mining Association of Great Britain, obtained from the Board of Trade confirmation of his reading of the Act. He seems to have sought the views of the Board of Trade at the instance of the Gas Coal Federation. Of course, at one time all knowledge of anything in the nature of a federation, combination, or whatever other name was applied to the body from which united action proceeded in connection with gas coal selling, was denied by some people who are intimately concerned in gas coal transactions. Their knowledge was very much at fault, because Sir Thomas was, in this instance, "instructed "by the Gas Coal Federation," to communicate with the Board of Trade, "in order to prevent differences arising "on these points."

The first question submitted to the Board was, to put it briefly [the text of the correspondence will be found on p. 521], as to whether, in ascertaining the corresponding price for the prescribed year ending June 30, 1914, it is necessary that the contract of the same buyer should be taken, or whether, if there was a contract with another buyer, *nearer to the corresponding date* of the proposed new sale—providing the coal was of the same description, sold in similar quantities, and under similar conditions—that contract could be taken in fixing the price. The reply of the Board of Trade is that, "so long as the conditions prescribed by section 1 "(1) of the Act are complied with, there is nothing in the "Act which requires that reference should in all cases be "made to a sale to the same buyer." It will be observed from the correspondence that, in putting his case, Sir Thomas used these words: "If there was a sale within the "prescribed period to any other person or company, nearer "to the date of the new sale, *where the price was more favourable to the vendor*, provided the coal comprised in the last-"mentioned sale was of the same description, and sold in "similar quantities, and under similar conditions, the Act "does not prohibit the price on such last-mentioned sale "being adopted as the basis price for the price under the "new contract." Note the words that are italicized by us: "Where the price was more favourable to the vendor." Sir Thomas was only concerned for the coal vendors, and not for the buyers. But the Act was not framed to bestow preferential conditions within its terms upon the vendor or the buyer. The interpretation, which gives greater freedom in bargaining than was generally supposed to be the case, of course cuts both ways. As it is not necessary, according to the interpretation of the Board of Trade for the sale during the year ending June 30, 1914, to refer to the same buyer, then if buyers ascertain, by any means available to them, the existence of a more favourable contract than their own during the prescribed year (providing other conditions are consistent) they should, if possible, arrange to enter into a new contract at or near the date of that favourable sale. It is obvious that, according to the correspondence, there is nothing to prevent this claim being made.

The next point is also one of especial interest. Most gas coal contracts in this country are entered into during the spring, for (say) the twelve months beginning with July 1. Some buyers have been of opinion that the basis prices which will have to be taken are those ruling for the coals delivered during the year ending June 30, 1914. But this, the correspondence shows, is not so if the contract was entered into on or before June 30, 1913. The Board of Trade says that in the case of a new contract reference must be made to a sale actually effected within the twelve months ending June, 1914. Therefore, in fixing the basis price for contracts which comply in respect of description of coal, quantity, and other conditions, the corresponding sales will be those arranged during the year ending June 30, 1914, though the deliveries only took place during 1915.

Dyes and High Explosives—After the War.

THAT certain requirements of peace and war are closely co-related, and that the establishment of the means of producing in one direction the needs of peace time supplies a national protection in war time, were points in the notable address of the Chairman (Mr. Milton Sharp) to the shareholders of the Bradford Dyers' Association at their meeting yesterday week. What he had to say bears largely upon the question of whether or not the gas-supply industry will, after the war, continue the policy and work of extracting from gas, by means of the "C" or other process, the benzol, toluol, &c., which are, with carbolic, sulphuric, and nitric acids, among the raw materials from which dyes and high explosives alike are made. We have ourselves very little doubt on the subject. The Government and the country have had such a startling lesson through the war that we shall never be—we cannot be if sanity prevails—allowed to recede from the position to which the war has compelled the country to advance in developing its own resources; if anything, we shall have to go still further forward. If (and this is a fact that should sink well home) we fully establish the aniline dye industry in this country, then we establish at the same time the means of production, in quantities only limited by the amount of coal carbonized, of those first essentials of our hope of ultimate victory in modern warfare.

Germany's success in founding and building-up to its mammoth proportions the aniline dye industry, and its largely established plant for extracting nitrogen from the air, have been the means by which it has succeeded in carrying on war so long, and with the intensity that it has been doing. What it simply did immediately the war started was to turn the huge factories, and the thousands of men employed, from the peaceful work of making aniline dyes on to the manufacture of high explosives, utilizing the same substances; and the production of ammonia fertilizers also at once gave place to the production of nitric acid. We award Germany the palm for original organization of potential resources with a dual purpose—commercial and martial. When, however, we compare the preparedness of Germany in the matter of explosives and its means of rapid larger production with our own shortsightedness and unpreparedness, and then survey what has since been done in this country, there is very deep appreciation of the words of Mr. Milton Sharp when he said: "The country will pro-"bably never know how much it owes to the High Explo-"sives Department of the Ministry of Munitions, presided "over by Lord Moulton, and officered by a body of strik-"ingly able and energetic men to whose commanding force "it is due that the danger from a shortage of high explo-"sives has been so effectively met." This from an independent but interested and keen observer! As Mr. Thomas Canning says in a letter in our "Correspondence" columns to-day, such merited praise must be very gratifying to gas engineers, seeing how much their patriotism and skill have contributed to the conditions which warrant the tribute.

Now we know more than we generally did before the war as to how much the industries of this country are dependent upon a plentiful supply, to an immense annual value, of dyes and colours; and we know, too, it is to its interest to be self-dependent in this regard. We realize, too, that the country must be in self-reliant position in respect of the materials for high explosives. The provision of the two vital necessaries—the dyes and colours on the one hand, the high explosives on the other—are interconnected. This being so, Mr. Sharp wants to know whether all the work, the experience, the plant, towards which indirectly and directly the Government have contributed a considerable sum of money (this does not apply to any great extent to the gas industry), are to be jettisoned after the war. He hopes not; indeed, they cannot be if the country in the respects mentioned is to be made self-contained and independent. This is one of few ways in which the war has been constructive; and it would, to use an expression employed by Mr. Sharp, be "criminal folly" to, after the war, enter upon the policy of destruction of this piece of good. Mr. Canning asks, in like manner, "if the excellent results which we in "the gas industry have discovered can be obtained by the "use of the Carpenter process and other means are to be "no further developed when the war is over, when it would "be so easy to divert the whole of the products into a new "channel, and place in the hands of England a power in "peace or war of incalculable advantage." It cannot be, and it must not be, that this source of value will be suddenly, or ever, cut off. It is part of the national development that the gas industry should continue this work. Something that the gas industry has is something that will be—in more than one direction—permanently wanted, to the fullest practicable extent. The industry has had remarkably informative lessons forced upon it through inexperience being displaced by experience; and we know now that large contribution can be made to the country's internal and material strength without doing consumers of gas using modern methods any appreciable harm. Mr. Canning is, therefore, suggesting that the Institution of Gas Engineers should take the matter into consideration with organized representatives of the dye users, dye producers, and tar distillers, with a view of urging the position upon the attention of Parliament, and of inducing them to take action "before the terrible words 'too late' are written over the "door of a lost opportunity of such magnitude." The proposal, we hope, will not fall on deaf ears. As an initial step, the Council of the Institution could not perhaps do better than get into communication with Mr. Milton Sharp. The reason for this suggestion is found in what that gentleman had to say on the general subject at the meeting of the Bradford Dyers' Association, as to-day reported in our "Miscellaneous News."

Investment of Accumulated Gas Funds.

The administrators of gas undertakings are, as a rule, provident people. They create reserve funds, special purposes funds, capital redemption funds (where they are required, and are allowed by Parliament), superannuation funds, sick benefit funds—in fact, their undertakings are hedged-about with funds with an eye to financial stability, security, and the needs of the future. There is great prudence in all this; but an important consideration is as to what is best to be done with the accumulated money. The general rule is—it is the rule that has had large application in the belief that it was framed by propriety and wisdom—that the money should be invested in securities, preferably gilt-edged ones, outside the business. This is the course, on which we look with a considerable amount of sympathy; but it is a course from which much preference is now being alienated in favour of the action of investing the money in a company's own business, and utilizing it for working or other capital purposes. There has been during recent years heart-breaking depreciation proceeding of the so-called gilt-edged securities; and the directors of gas undertakings with investments in these securities have had to recognize that the amount of the reserves that they placed as solid cash on one side have not the realizable value of the original sum, and substantial writing-down has been necessitated. And, of course, with the war, and with new Government loans at high rates of interest, the various "securities" in which reserves have been invested are in worse case than ever, and just at the time when, the raising of fresh capital for trading enterprise having been prohibited, or its raising only sanctioned on war-bound conditions, the money would have been of the utmost use within the business itself for the provision of the greater stocks which the prevailing conditions compel works to carry, and for maintaining at as high a level as possible the inflow of new business. When all the conditions are looked at in the light of the security depreciation that preceded the war, and of the circumstances of to-day, one finds sympathy veering round from the advocates of investment outside the business to the advocates of investment within the business.

We have before us this week a lament on the subject by Mr. H. E. Jones. It is hidden away in almost the final remarks that he made at the meeting of the Wandsworth, Wimbledon, and Epsom Gas Company last Tuesday. In the flush of patriotism, the Directors have made a fairly considerable conversion of 2½ per cent. Consols (which represented reserve fund and special purposes fund investments) into 4½ per cent. War Loan; and in the operation a sacrifice has been made of only a few pounds short of £7000 on the original investment. If the Company had had to realize the Consols in order to provide the undertaking with ready money, they would, of course, still have had to make a considerable sacrifice. But the difference would have been this, that instead of now holding 4½ per cent. War Loan, the Company could themselves have found profitable employment for the money, and could have afforded to pay 5 per cent. interest upon it. If the money had been originally invested in the Company's business at 5 per cent., no depreciation would have been suffered. The Directors do not by any means regret what they have done in converting from Consols to the War Loan. But when the solid amount that has gone in depreciation confronts them, when the dearness of money is considered, when capital (even if allowed to be raised) cannot be obtained, under current conditions, excepting at below par, or in the case of loan capital at a severely high rate of interest—well, then, it is not surprising that Mr. Jones and his colleagues think that the Wandsworth undertaking could well take charge of its own accumulated funds, allow 5 per cent. interest on them, and permit them to suffer no depreciation through external causes. The subject of outside investment or investment in the business itself of reserve and other funds is an old and oft-debated one; but, as already said, the weight of argument respectively on one side and the other is being shifted by circumstances. Of course, much depends on conditions. A sound well-established gas undertaking is quite a safe repository for accumulated funds; an undertaking of contrary characteristics, or indulging in a business of speculative nature, would not be. A British concern, too, carrying on business abroad should have its reserve and other funds invested at home, rather than in the business in another country. Circumstances alter cases.

Investigating the Pitch Problem.

Those who read last week's issue of the "Journal" carefully will have seen that the question of carbonizing pitch with coal for the purpose of doing something towards making an impression upon the rate at which stocks are accumulating is gaining ground in consideration and experiment. The matter was raised by Mr. Tim Duxbury at the meeting of the Manchester District Institution of Gas Engineers, and by Mr. G. Stanley Cooper, B.Sc., at the meeting of the Coke-Oven Managers' Association; and at both (as the reports published last week show) useful experiences were recounted by members. But, on all hands, we seem in this matter to be still in the experimental stage; and there is as yet nothing to record of practice on continuous large-scale working. There is, of course, a freshness even in the revival of this old idea of pitch carbonization; so that a little time must necessarily elapse before anything substantial is done.

Meantime stocks continue to accumulate, despite the recommendation of the Ministry of Munitions that there should be disposal of pitch by its carbonization. The interest of the Ministry of Munitions in the matter we suppose lies in the fear that the piling-up of pitch stocks may have some effect upon the full operation of tar-distillation plants, and thus upon the recovery of toluol. An outlet for pitch there must be; for, as we have said before, and as Mr. Samuel Glover and Mr. H. Kendrick intimated at the Manchester Institution meeting, the rate at which we are building-up pitch stocks is going to have, unless prompt relief comes, a very bad influence upon the market in the future. In order to ensure that there shall be no slacking off in the operation of tar-distillation plants, the Ministry of Munitions ought to see if they cannot do something more than merely recommend tar producers to enter upon what is in carbonization practice a complete innovation. Our Allies are wanting briquettes; for briquette making, they require pitch; but they cannot afford to buy it from us because of the rates of freight. Therefore if the Ministry of Munitions could induce the Government to arrange for some vessels at moderate rates of freight for this trade, they would be conferring a blessing all round, and be doing more to relieve the pitch situation than the sluggish tentative work that is now proceeding in this country with the view of determining upon some measure of relief. Moreover, it is coal that the Ministry of Munitions want carbonized, and not pitch, in order to obtain the maximum result in the production of high explosives.

However, there is a disposition to look at the question of the carbonization of pitch from the immediate financial point of view. Of course, it depends upon the price at which the 5 per cent. or other percentage of pitch is put into the retorts with the coal, as to whether or not the practice is profitable; and, as a definite test of this, we should be loth to accept money results calculated on the basis of working experience with easily managed experimental plants. If the figures of Mr. Duxbury (or the prior ones published by us of Mr. Thomas Glover and of Mr. Alex. Yuill) are taken, a ton of mixture—90 to 95 per cent. coal and the balance pitch—does not give working results that vary much up or down from ordinary working. Mr. Duxbury shows little difference in gas make per ton; but there is a small advantage in calorific power. There is an increase in the weight of coke, which is of "good" quality (in one place he says "improved" quality); and there is an increase in the quantity of tar, which, under the conditions of his experimental working, contained more naphthalene, with reduced water content, and the toluol was also diminished per ton of tar from 2·46 gallons to 2·04 gallons—0·42 gallon difference—but per ton of coal carbonized the average production increased from 0·141 gallon to 0·173 gallon. The members who joined in the discussion at the Manchester Institution meeting were, on the whole, of opinion that, having regard to the future position of tar, the carbonization of pitch, when properly intermixed with coal, was a feasible economic proposition under current circumstances. This is the way to look at the matter. So long as the carbonization of pitch does not impose any present disadvantage—financial or working—then the extent to which it is carbonized now will be a gain for the future.

From the remarks on the subject at the meeting of the Coke-Oven Managers' Association, it appears that not much progress has been made in experiment with pitch carbonization at the coke-ovens; and what experiment there has been does not seem to have been consistently carried out by proper application. It is the opinion of Mr. Stanley Cooper that, for the purpose which is urging interest in this matter, coke-ovens can without disadvantage do a practical part in relieving the present congestion, and the still growing congestion, of the pitch-stores up and down country. Other coke-oven men think the same; but some again have not had a particularly good experience. This, however, appears to have been largely due to faulty or haphazard mixing of the pitch with the coal, although known percentages of pitch were employed. Under this condition, the flame and smoke were so great on the introduction of a charge that the men could not get sufficiently near to put the oven-lids in position. Intimate admixture, and the use of a hard pitch from which some of the lighter constituents have been removed, make a great difference in coke-oven working. In his article in our columns on Feb. 1, Mr. Thomas Glover remarked: "The coke-oven manager may take an important part in this beneficial movement; and probably "greater direct benefits accrue in the case of coke-oven "products, and in the financial results of working, than in "those of a gas-works." The discussion at the Coke-Oven Managers' Association indicates that some of the members are a little doubtful as to "direct benefits," save in the one respect that the use of a proportion of pitch may permit of the utilization of inferior coals and even non-coking coals, and yet, through the binding action of the pitch, produce hard coke of good size. This would be a direct advantage if only it proves to be true; and we see every reason why it should do so. However, the President of the Association (Mr. George Chrisp) is proposing to make experiments with non-coking coals and pitch; and the issue will be awaited with much interest. Meantime pitch accumulates; and any measures taken to produce relief should be applied as quickly as possible, and not at the end of the war.

Reported Government Control of Gas-Works.

There has been a little trouble with certain boiler attendants at the works of the Edinburgh and Leith Gas Commissioners. They are under the impression that they deserve an increase of wages in addition to the war bonus, and, because they could not get what they wanted without arbitration, they threatened to strike. The gas undertaking, in common with several hundreds of others, is working for the Ministry of Munitions; and, in the difficulty, the Department was approached by the Commissioners with a view to having the works placed under Government control, and so prevent stoppage of any part of the operations. The point of general interest about the matter is that the deputation to the Ministry of Munitions was informed that an order is to be issued shortly with the view to bringing under the Munitions of War Act, 1915, and the Amendment Act of 1916, all those gas undertakings that are assisting in the recovery of benzol, toluol, &c. At many gas-works, the loyalty of the men is such that they would just as soon think of deliberately inflicting some personal injury upon themselves as to harm in any degree the national cause and the public service in these times when every man's work is required of him in contributing to the defeat of the enemy. But there are other works where there has been unrest, and where men have actually ceased work during the war. We will not say all that such men deserve to have said of them. It is through such men that the reported action is necessary in the matter of Government control. The Edinburgh and Leith Commissioners have already received regulations which place their manufacturing plant, but not finance, under control. Now questions in dispute must be referred to arbitration. It will be noticed from a report elsewhere that, apart from the question with the boiler attendants, an enhanced war bonus has been (with certain exceptions) granted to the Commissioners' employees.

Farmers and the Price of Sulphate of Ammonia.

If the farmers do not quickly make up their minds on the subject of sulphate of ammonia, the Government should relieve the present absurd situation by again allowing free export. It was for the British farmers' especial benefit in the way of large supplies that exports were stopped, although prior to this event, and when sulphate of ammonia was much cheaper, the farmers only absorbed about a third of the production of the United Kingdom —the immense remainder having to find markets abroad. The agriculturists really got the Government to prohibit export under false pretences. When they moved in the matter, it was represented that, in the presence of the shortage of other fertilizers, and in view of the demand, and the high prices obtainable, for land produce, there would be little difficulty in absorbing the home yield of sulphate of ammonia. Their action in holding back from purchasing now shows that the object of their successful move in prevailing upon the Government to prohibit exports was —though they are getting high prices for their produce, though coal, sulphuric acid, labour, and all other expenses have grown tremendously for those engaged in sulphate of ammonia making, though the markets of the latter have, as the event shows, been ridiculously curtailed—to bring down the price. The £16 10s. per ton fixed for February is below the values that have lately been reached; but because prices have not come down with a run, the farmers are leaving makers in possession of growing stocks, although at the price at which the commodity is being offered, it gives the farmers one of the cheapest forms of nitrogen for fertilizing purposes. Still, instance after instance of their agitation for price reductions occur—one of the latest being reported in our "Miscellaneous News" columns to-day.

Innocuous Gas-Fires.

It will be seen from an article elsewhere in this issue that the first report of the Committee appointed for the Investigation of Atmospheric Pollution has been published; and it is a very valuable document. The Committee is one in which there can be the utmost confidence; and the names of the members are an assurance that the work in hand will be done in a conscientious and thorough manner. Armed by the report, those who are engaged in the work of supplanting smoke-producing means of heating by smokeless ones will find that those who try to oppose them on hygienic grounds will have a difficult task. The Committee allude to the innocuous character of the gas-fire compared with the coal-fire. The tarry and carbonaceous substances produced by the use of raw coal have no part in the products of combustion of a gas-fire. In the case of a coal-fire, consuming 21 lbs. of coal per day, besides the tarry and carbonaceous products, some 1500 grains of sulphur in various forms are evolved, as compared with only 50 to 60 grains in the case of a gas-fire consuming 200 cubic feet of gas per day. The Committee, in fact, put the case for the gas-fire in a nutshell from the air pollution point of view, when they state: "The products of combustion from a gas-fire consist mainly of carbonic acid and water vapour, together with a minute quantity of sulphur oxides." Contrast this statement with what precedes it as to the constitution of soot and the emanations of a coal-fire chimney, and all right-thinking people will plead for the hastening of a general transfer from the use of crude coal to the employment of gas or coke in all heating operations.

Tar-Surfacing and Atmospheric Pollution.

Reading the report, however, we have a rude shock. The Committee state that tar in the atmosphere is produced not only by the imperfect combustion of coal or wood, but, recently, by the introduction of the practice of tarring roads. It is not clear what evidence the Committee have that tar-surfacing of roads is a contributory source of the tarry element in the atmosphere. Looking down the columns in the tables referring to tar, there does not appear to be any distinct testimony of road-tarring operations having contributed to the tarry element in the atmosphere. It would be very difficult in the industrial areas to trace this, owing to the local manufacturing conditions. But it may be assumed that, in and round about such a neighbourhood as Malvern, road-surfacing by tar is largely indulged in, and yet the figures applying to that area do not suggest anything more than what one might assume would be found as the result of the ordinary combustion of coal in the district. The figures in the tables are given in metric tons per square kilometre; and for the twelve months ending March, 1915, they are for Malvern as follows: April, 1914, 0·00; May, 0·02; June, 0·01; July, 0·01; August, 0·01; September, 0·01; October, 0·00; November, 0·01; December, 0·01; January, 1915, "Trace;" February, 0·00; and March, 0·00. Since the war started, there has been comparatively little road-tarring done in the country; so that any general assertion as to road-tarring having contributed to the tarry element in the atmosphere should at present be avoided, or have reference to time and place. We should like to see figures for twelve months from a district prior to the road-tarring practice being commenced, and then for a normal year of road-tarring, to ascertain whether there were any perceptible differences. Of course, variations in local and atmospherical conditions would affect the results; but we should hesitate to accept without stronger evidence that the tarring of roads has had much, if any, effect on the quantity of tarry substance found in the atmosphere. Even if there has been some effect, the compensations of road-tarring are worth it. We have through the practice a cleaner atmosphere, a less quantity of irritating substances is mixed with the air we breathe, the foliage of trees is kept free from choking dust, and local economy is promoted by greater road durability. Of course, these are things the Committee would not dispute; and the remark in the report to which we have referred was not, we feel sure, made in depreciation of the practice.

Domestic Supply Prices.

The time is hardly propitious for voicing requests for a cheaper supply of gas—though isolated cases of a lowering of price have come to hand, even during these days of abnormally high costs of materials and labour. But supposing the time was one in which there existed general circumstances that would seem to warrant an application for some concession in the price charged for gas, then one would anticipate that Sheffield would be almost the last place where such a demand would be made. Sheffield has long enjoyed the undoubtedly great benefit of a cheap gas supply, though, as is the case in the overwhelming majority of other places, prices are somewhat less favourable now than they were before the war broke out. The writer of "Engineering Notes" in the "Sheffield Telegraph," however—possibly realizing that there can be no harm in asking —says, "Let us have cheaper gas." The system of charging 10 per cent. on the rateable value of a house, and a halfpenny per unit for all current consumed, has caught his fancy; and he inquires whether the Gas Company ever considered some such system of charging. It is highly probable that they have, and that as a result they concluded that the most satisfactory plan was to charge ordinary domestic consumers, both large and small, at one rate—the lowest that due consideration for the rights of the stockholders would justify. The advisability of charging differential prices for domestic purposes is a question that has been many times debated, and is one upon which opinions have naturally not always agreed; but gas undertakings have, at any rate, not felt the necessity of imposing the complicated systems of charging which have in so many cases constituted a feature in the operations of their electrical competitors. For regular consumption for power and industrial purposes, the Sheffield Company, of course, allow terms which prove very inviting to manufacturers; but this policy is governed by different considerations from those applying to domestic consumers—of no doubt irregular demands—of giving "a liberal discount on the last quarter, if a certain amount of gas has been used during the year." There is no wish to judge the case for the Directors of the Company, who are quite able to appraise at their true value the arguments adduced. We are only surprised, as has been said before, that Sheffield should be the place selected for this demand for cheaper gas.

OBITUARY.

Much sympathy will be felt for a family bearing an honoured name in the gas profession, at the announcement of the death last Wednesday at Armagh of Mrs. Whimster, the wife of Mr. James Whimster, J.P., the Engineer and Secretary of the Armagh Gaslight Company. One of Mrs. Whimster's sons is Engineer of the Bath Gaslight Company, while another one has for some years been assistant to his father at Armagh.

When presiding at the annual meeting of the Carmarthen Gas Company, Mr. John Lewis (the Mayor) said the Directors much regretted that during the past year two of their former employees, who had joined the army, had passed away—one was killed in action, and the other died while in this country. Another employee was in hospital in Egypt. They all extended their deepest sympathy and condolence to their respected Manager (Mr. B. A. Lewis) and Mrs. Lewis in the great loss they had sustained by the death of their son Harry, who was clerk in the Company's office for many years.

Sorrow was expressed on all hands at Exmouth on Monday of last week when it became known that Mr. J. T. Foster had passed away. Deceased had been in failing health for some years; and it was largely in consequence of this fact that in May, 1914, he tendered his resignation as Secretary and Manager of the Exmouth Gas Company, a position he had held for 28 years. The loss of his only son, Second-Lieutenant J. S. Foster, of the 9th Somerset Light Infantry, who went down with the transport "Royal Edward" in the Ægean Sea last August, was a great grief to him; and it was generally anticipated that, in his already enfeebled condition, Mr. Foster would not long survive such a severe shock. Under his able management, the gas-works were remodelled again and again. There were only four employees —two stokers and two yard men—when he joined the staff in 1886. On his retirement, however, the staff numbered well over fifty, and included ten or a dozen fitters. In 1886 the make of gas was about 13 million cubic feet; while in 1913, the last year of his management, the Company manufactured 72½ million cubic feet. Only a month or so before his retirement, Mr. Foster had the satisfaction of obtaining for his Company the public lighting contract for Exmouth for a period of ten years; while the last enterprise under his direction was the opening of showrooms.

At the next meeting of the Illuminating Engineering Society on the 21st inst., there will be a discussion on "Some Aspects of the Design and Use of Glassware in Relation to Natural and Artificial Illumination."

The annual meeting of the Midland Association of Gas Engineers and Managers has now been definitely fixed for Thursday, the 23rd inst., at the Grand Hotel, Birmingham, when the President-elect (Mr. Charles H. Webb, of Stourbridge) will deliver his inaugural address.

The second industrial fuel number of "A Thousand-and-One Uses for Gas" contains the continuation of an article by a Furnace Expert, based on the paper read a short time ago by Mr. B. W. Brooks, of the Gas Light and Coke Company, before the London and Southern District Junior Gas Association.

Among recent wills proved are those of Mr. Jabez Light, late Deputy Chairman of the South Suburban Gas Company, who left a gross personalty of £43,867; of Mr. J. H. Campion Coles (the predecessor of Mr. J. S. Garrard as Secretary of the Eastbourne Gas Company), the gross value of whose property was £61,458; of Mr. Thomas Parker, of Ironbridge, Salop, known to "Journal" readers in connection with the "Coalite" companies, who left estate valued at £13,380 gross; and of Mr. John Gilbert Russell, of Aldridge, Staffs. (of the firm of Russell Bros., tube manufacturers), who left £111,510 gross.

PERSONAL.

Mr. J. G. Newbigging, jun., who is on active service in France, with the 18th Royal Fusiliers, attached to the 251st Mining Company of the Royal Engineers, is returning to England for a few weeks' convalescence, having been in hospital for some time suffering from trench fever. While in England, he expects to take up a commission in the Royal Engineers, which was offered to him some time ago.

In succession to the late Mr. O. Pihl, the Board of Directors of the Christiania Gas-Works, at their meeting on the 25th ult., appointed (subject to confirmation by the Commune) Mr. J. G. Tooms as Engineer and General Manager of the present works, in addition to his former position of Chief Engineer for the construction of the new gas-works in the city. Mr. Tooms, it may be remembered, was formerly Manager of the Waterford Gas-Works, and was for many years a prominent member of the Irish Association of Gas Managers.

The salary of Mr. W. B. Leech, the Engineer and General Manager of the Leeds Corporation Gas Department, has been increased by the City Council from £800 to £1000 per annum. In submitting the recommendation of the Gas Committee to this effect, Alderman W. Penrose-Green (the Chairman) said that, when Mr. Leech was appointed, he was debarred from consulting work and from giving expert advice; and there was a tacit understanding that, if he carried out his duties satisfactorily (as he had done), the Committee would recommend an advance of £200 a year. An amendment that no advances be made in respect of salaries of over £200 a year was defeated at last week's meeting of the Corporation; the Committee's minutes being approved by 27 votes to 14.

NEW COAL CONTRACTS AND THE PRICE OF COAL (LIMITATION) ACT.

Fresh Interpretations.

Acting upon instructions received from the Gas-Coal Federation, Sir Thomas Ratcliffe-Ellis, Secretary of the Mining Association of Great Britain, has obtained two fresh interpretations of the Price of Coal (Limitation) Act, with special reference to the fixing of the basis price for new contracts.

The Points for Decision.

The letter sent to the Board of Trade by Sir Thomas Ratcliffe-Ellis is as follows:

The time is approaching when gas companies will desire to make arrangements for their new contracts; and a question has been raised which may cause difficulties in the negotiations.

I am told that there is a prevalent opinion among buyers that a purchaser desiring to make a new contract is entitled to have the price fixed by comparison with the corresponding price in the expiring or expired contract. I have advised the coalowners that the Act does not require that the corresponding price shall be so ascertained. It may be that the price under an expiring or expired contract, in a particular instance, may afford the proper data in that case, upon which the price for the new sale must be fixed, in compliance with Section 1 of the Price of Coal (Limitation) Act; but that if there was a sale within the prescribed period (the year ending June 30, 1914) to any other person or company, nearer to the date of the new sale, where the price was more favourable to the vendor, provided the coal comprised in the last-mentioned sale was of the same description, and sold in similar quantities, and under similar conditions, the Act does not prohibit the price on such last-mentioned sale being adopted as the basis price for the price under the new contract.

Another question which has arisen is, whether the price under a sale of fuel made before June 30, 1913, can be taken as the basis for ascertaining the corresponding price under a new contract. Whatever may be the position with reference to such a question under a revision of an existing contract, I have advised that the corresponding price with respect to a new contract must be fixed with reference to a sale made in the twelve months ended June 30, 1914, and cannot, under the provisions of the Act, be compared with the price under a sale made before June 30, 1913.

I am instructed by the Gas-Coal Federation, in order to prevent differences arising upon these points, to ask if the Federation may be favoured with an official opinion of the Board of Trade as to whether the opinions I have expressed are those in which the Board of Trade concur.

Board of Trade Reply.

In reply to your letter of Feb. 4 on the subject of the Price of Coal (Limitation) Act, I am directed by the Board of Trade to say that they agree that—

As long as the conditions prescribed by Section 1 (1) of the Act are complied with, there is nothing in the Act which requires that reference should in all cases be made to a sale to the same buyer;

And further that, in the case of new contracts, reference must be made to a sale effected in the twelve months ended June, 1914.

ELECTRICITY SUPPLY MEMORANDA.

Official Pressure Testing.

The London Borough Councils owning electric supply undertakings have lately been trying to get rid of pressure-testing by the London County Council. The reason for this is not altogether clear. The Councils speak of their desire as referring only to the period of the war; but we have some suspicion that they would like to see pressure-testing permanently abolished. The asserted reason for the desire is that the Government advise financial economy while the war lasts; but it would be interesting to know the amount of the economy to the individual electricity supply undertakings that would be achieved by the discontinuance of pressure-testing. The testing stations have already been equipped; and even the aggregate annual outlay cannot therefore now be a weighty matter. In the event of the failure of this contention as to financial economy, the Borough Councils also refer to the waste of men that the testing involves, when manual power is so much in demand. The work associated with pressure-testing is of a kind that does not require men coming within the military age. The County Council have given courteous consideration to the representations of the Borough Councils; but they cannot find that the Borough Councils have made out any substantial case for discontinuance. Then "Meteor" of the "Electrical Times" stepped in, and apparently thought to help the Borough Councils by being funny and extravagant.

Contradictory Hyperbole.

In his comments upon the subject, "Meteor" writes for amusing effect and little else. He derides the County Council and all their works in this connection, accuses them of only wanting to assert their overlordship in this particular matter, of doing this at considerable expense—in fact, thousands of pounds sterling were entailed in providing this testimonial to the "majesty" of the London County Council; and from all this expenditure only "foolish little inspection stations" issued. There came through the post to the "Electrical Times" office a letter from Mr. E. W. Low, who, believing in calling a spade a spade, told "Meteor" that he was writing "absurdities and inaccuracies." The County Council, of course, carry out this pressure-testing in compliance with their statutory obligations, and nothing else. There is no "overlordship" or "majesty" in the matter. Mr. Low also wanted to know why the Borough Councils sat quietly by while (if true) "thousands of pounds sterling" were being spent by the County Council on "foolish little inspection stations." "Meteor" climbed down. He could not supply a direct reply to the criticism of this particular absurdity of his, which came of not giving some proportion to his selected hyperbole, and so preventing one point abrogating another by inconsistency. "Meteor" also suggested that, if the pressure inspection stations be discontinued, several miles of good chart paper could be saved every month. Several miles of chart paper in these "foolish little inspection stations!" As a matter of fact, about 12 inches of chart paper will go the round of twenty-four hours. The editorial reply to "Meteor's" critic did not touch the practical points raised. There was a little wordy meandering round about; but a respectful distance was maintained from the solid criticism. But as one reason for not testing electrical pressures (about electrical pressures some rather cutting things have been said by people who have experienced their varying effects in lighting and heating work), the editorial mind suggests that "if there is the slightest thing wrong with the pressure of the electrical supply, it is obvious to the consumer." Maybe; but what can the consumer do in such an event? There must be some body to look after his interests; there must be some means of making actual test, and some official record, in order to ensure effort being made to keep things right. No one would be prepared on the mere *ipse dixit* of a consumer to bring a borough council or company to book for erratic voltages. Something more is required.

Testing in the Provinces.

It is also pointed out, presumably as a reason why London should not have electrical pressure-testing applied to it, that this is not done in the provinces. But a start must be made somewhere. The gas industry knows something about this. London has very often been the starting-place for the application of new gas legislation; and gas supply is now tested for all sorts of things in city and country town alike, with penalties attaching for deficiency. Why the gas industry, and not the electrical industry? But where electricity supply has the advantage of the gas industry is that the major number of provincial electricity supply undertakings are in the hands of local councils, who are also the testing authorities. If, therefore, they do not want to have the electricity supply tested for pressure, they are not likely to incorporate the power in an Act of Parliament or Provisional Order. As a matter of fact, it is not much good a local authority testing against itself, for reasons that are so palpable that the space required to mention them here may well be saved. However, the London County Council do not see any reason why testing-stations brought into being at an expenditure of "thousands of pounds sterling" should lie idle during the war, if a better case cannot be presented than that submitted by the Borough Councils, and the singular one in support prepared by "Meteor."

Lamp Flicker and Small Plants. Fluctuations of voltage will cause variation of illuminating power of incandescent electric lamps; but what is known as flickering has generally been associated with arc lamps and not incandescent ones. A writer hailing from India tells the "Electrical Review" that he has under his charge three Belliss-Crompton direct-current generating sets, rated at 50 and 100 KW. at 450-550 volts. A single machine at present works at one time; and the load is metal-filament lamps and fans. With this plant, he experiences trouble with a flicker of the lights, which seems to synchronize with the engine beat; but no one appears to be able to assign a cause for it. It does not always occur, but is sometimes scarcely noticeable, and at other times it becomes objectionable. All the machines seem to be affected, but not to the same extent—the small set being the worst, and one of the 100-KW. sets. The third set very occasionally gives trouble, and then only slightly; and it has been found that changing over to this set will stop the trouble. The flicker appears to start at half load on the first two machines, when the bus-bar voltage is about 485-490. The machines have only been in use two years, but this flicker was noticed from the beginning. The writer is very anxious to find an explanation of the peculiarity and a means of remedying it. No doubt. Jumping lights are things that people cannot tolerate.

The Passing of Arc Lamps. In American cities the arc lamps that have been engaged in the duty of street lighting are now being mercifully sent into retirement and the nitrogen filled "half-watts" are taking on themselves the public function. The intelligence comes *viâ* the "Electrical World" that all the arc lamps in New York are to be replaced by large gas-filled tungsten lamps, under the terms of the contracts entered into for 1916 with the different lighting companies supplying the city. The new gas-filled lamps will range from 100 to 400 watts in size; and the ordinary type tungsten lamps from 40 to 100 watts. During 1914 the city finally decided to discontinue the use of flame arc lamps. Beginning with 1915, there were in service 18,211 arc lamps, many of which were superseded during the year by gas-filled tungsten lamps, while this year the remainder are to be replaced, resulting in a saving in the larger sizes of about $10 a lamp over the arc lamps. It is stated that, besides saving money, it was found by careful investigation that the gas-filled unit afforded a more uniform distribution of light than the arc lamp, without glare or flicker, and had much greater penetrating power in stormy or foggy weather. Where city or town authorities prefer for street lighting electric lamps without considering the higher efficiency for the purpose of high and low pressure incandescent gas-lamps, then let us by all means have the most efficient type of lamp. Unless, however, the filament of the nitrogen-filled lamp is screened from view, we dissent from the statement that it is without glare.

Electric Cooking Installations. We have taken the liberty of purloining from the "Electrical Times" a recently published table which includes all the installations that can be scraped together of electric cooking apparatus of any magnitude. These installations are the result of many years' hard work, supplemented by the comparatively little amount of installation in smaller business and public establishments and private houses, which installations ebb and flow in number in an interesting manner, particularly to those gas managers who have appeals for help, and the installation of gas-cookers. The table is as follows:

Name and Town.	Date Opened.	Total Loading. K.W.
Munition Works, near Newcastle	1914-5	250
Torquay Pavilion	1912	140/150
Euston Station Restaurant	1915	130
Blackpool Tower	1914	119
Bradford Kursaal	1915	102
Debenham and Freebody, London	1911	100
Park Prowitt Asylum, Basingstoke	1916	96
Regent Street Polytechnic	1912	93
Selfridge and Co., London	1915	90
Swan and Edgar, London	1916	80
Whitehall Café, Derby	1915	70
Bank of England	1913	70
Tricity House, Oxford Street, W.	1912	70
King Edward VII. Hospital, Sheffield	1915	63
Bunting's Rest, Norwich	1913	60
Old Ship Hotel, Brighton	1913	60
Dudeney and Johnson, Luton	1915	60
Harvey Nichols, Knightsbridge	1913	57·2
Winter Street Hospital, Sheffield	1915	57
Swan and Hunter, Wallsend	1915	55
B. and K. Restaurant, Earl's Court	1913	52

First of all, note the years of installation, which tell of slow growth. Then observe the number of substantial installations which the electricity industry has succeeded in getting in five years; then deduct those installations which are simply advertisements for electricity supply departments; make a further deduction of those to which special terms (unadvertised) have been conceded, in order to give the electricity departments something about which to talk; and, finally, make some allowance for those installations which have been made through the existence of personal influences. The table will then have a very thin appearance. But all told these installations—advertisements, decoys, &c.—are but a drop in the ocean of requirement for cooking apparatus, such an immense part of which is now supplied by the gas industry.

Electrical Wiremen. In most cities and towns, one gas engineer and one or more assistant engineers, with chiefs over the various departments, are all the technically trained officials required; but it would be a bad look-out if the business supporting such a staff could only give employment to an equal, or a smaller, number of fitters. The same with electricity undertakings. But though there should be a large excess in number of efficient wiremen over the engineering staff, information published in the electrical papers shows that there is quite a rush of candidates for the City and Guilds of London Institute examinations in "Electrical Engineering," but in "Electric Wireman's Work" there are relatively few candidates. Last session's report shows that electrical engineering was taught at 117 centres, and electric wireman's work at only 57. There were 1341 candidates for examination in "Electrical Engineering," and only 253 in "Electric Wiring." The number 1341 excludes telephony, telegraphy, and electro-metallurgy. An electric wireman should have a good technical knowledge of his work to prevent him making silly blunders; and therefore it is surprising that the figures as to the candidates were not reversed. The reason for this state of things is not clear. Perhaps the gentlemanly calling of an "electrical engineer" has greater attractions to some than the less gentlemanly calling of electric wireman, though certain electrical engineers are not paid much better salaries than a wireman's wage, notwithstanding the responsibilities of the latter are much less. Perhaps, too, some reason for the disproportionate figures is to be found in the amount of skilled supervision that is required to see that the thousand-and-one rules that are supposed to be needed to make an electricity supply safe (but which do not always do so) are observed, and in the skilled inspection that is requisite of such things as electric cooking and heating appliances, electric motors, and so forth. Of course, all those who pass the City and Guilds examination in "Electrical Engineering" do not find an electric station waiting anxiously for an engineer-in-chief or an assistant engineer. If 1341 candidates for the "Electrical Engineering" examination can be found in a war year, the number of those who have sat during the passing years to demonstrate their proficiency must be an enormous one. No wonder the supply of electrical "engineers" far exceeds the demand.

A New Light Screen.

At the moment of noting a new, and additionally stringent, lighting restriction order for the metropolitan district, we are also able to draw attention to an anti-aircraft light screen which is being introduced by Messrs. Falk, Stadelmann, and Co., of Farringdon Road, E.C. Where street lighting is still carried out, it is, throughout the greater part of the country, under very subdued conditions; and the efficacy of the "Diffusa" screen (which, it may be remarked, is provisionally protected) should be tested by lighting authorities and engineers in such areas. The screen consists of a series of three conical metal rings, finished dead-black, placed one above the other, in such a manner as to cut off all upward rays, avoid the production of bright spots of light, and yet afford satisfactory and well-diffused illumination at all angles below the horizontal. It is thought that an arrangement of this kind will have advantages over the plan of shading, painting the tops of globes, masking the greater part of the depth of lanterns, or coating with opaque lacquer, which results in spotty illumination. In addition to streets, the screens are suitable for use in factory and goods yards, wharves, railway stations, camps, or in any position where some lighting is necessary, but where that which is provided must be shielded from the view of hostile aircraft; and they are designed to be employed in connection with upright or inverted gas-lights and electric lamps. For use with Kern and similar upright burners, hooked supporting metal straps at the top of the screens can be easily adjusted to suit glasses of different diameters; while for the "C" burner, there is a wire cradle, which rests on the gallery of the burner. When attached to inverted burners, metal straps are passed through the reflector opening, and bent back in such a way as to allow of glasses being fitted in the usual manner. From what has been said, it will be gathered that the attachment of the appliance calls for no alteration to existing lanterns or reflectors. It is out of no disrespect to the "Diffusa" screen that the hope is expressed that the need for its use may very soon be altogether a thing of the past.

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Military Service Act Appeal Tribunals.—Last Tuesday's "London Gazette" contained the names of members of Appeal Tribunals appointed to sit in different areas, under the provisions contained in the Second Schedule to the Military Service Act, 1916. On the Tribunal for the County and City of London there are twenty-five members, one of whom is Mr. Charles Carpenter, D.Sc., the Chairman of the South Metropolitan Gas Company. One of the fifteen members on the Tribunal for the County of Norfolk (including Norwich and Great Yarmouth) is Mr. Edmund G. Smithard, J.P., the Manager of the King's Lynn Gas Company.

UTILIZATION OF WASTE HEAT IN GAS-WORKS

FOR THE RECOVERY OF FODDER AND FAT FROM KITCHEN REFUSE.

An article by Dr. A. Frank, a Professor at Charlottenburg, on the recovery from kitchen refuse of dry fodder and fat by the aid of the waste heat from gas-works and other industrial works, was recently published in the "Journal für Gasbeleuchtung." Some points in the article are of special interest to gas engineers, while throwing light on the difficulties being experienced in Germany in obtaining supplies of fat and feeding stuffs. The following is a summary of the article.

The cutting-off of the importation of fodder into Germany has drawn attention to hitherto neglected native sources of feeding stuffs, and especially to the large daily production in big towns of household and kitchen refuse. On Nov. 27, 1914, the Ministers of Agriculture and of the Interior caused a circular to be issued in Prussian towns urging the local authorities and the inhabitants to take steps to prevent the waste of such refuse. Local conditions and customs, and the necessity for the provision of new plant for dealing with the refuse, prevented any extensive adoption of the recommendations. To the technical man, however, it was clear that if kitchen refuse were rapidly dried in suitable plant—being thereby disinfected and concentrated—it could be transformed into a marketable concentrated fodder. The Ministers quoted Professor Hansen, of Königsberg, as their authority for the statement that by drying kitchen refuse there could be produced a refuse meal having a food value of 67·3 to 68·3 per cent., compared with 67·9 per cent. for winter barley, and exceeding that of wheat bran, which, notwithstanding its high proportion of 9·8 per cent. of albumen, has only a total food value of 42·8 per cent.

The importance of these figures is shown by the fact that in 1913 Germany imported for maintaining its live-stock 3 million metric tons of winter barley and 1·4 million metric tons of bran, in addition to 3·3 million metric tons of other concentrated stuffs. Dr. Frosch, the Director of the Hygienic Institute of the Veterinary College at Berlin, has shown that the material produced by drying the refuse is completely sterilized and harmless, and that it may be advantageously used for fodder both for milch cows and fat stock. The demand for fodder has increased to such an extent that the normal price in time of peace, of £5 10s. per metric ton, is now nearly trebled; yet the scheme for the manufacture of fodder on the lines indicated has made only slow progress. This is partly due to indifference and lack of intelligence on the part of the housewife, who will not undertake to separate useful refuse from the ashes, crockery, paper, &c. In unorganized working, also, the cost of manufacture is very high. Lately, however, stress of circumstances has led to some improvement; and more careful separation of kitchen refuse from the rest of the household refuse has been made obligatory, and is being carried out.

A most important point in the scheme, however, is that, in addition to economy of fuel in the drying process, advantage should at the same time be taken of the recovery of the large quantities of fat from kitchen refuse. The desired economy could easily be achieved by substituting the waste heat which escapes through the chimneys of large works (especially of gas-works) for special furnaces for heating and drying. This heat should at the same time, it is pointed out, be utilized to extract by previous treatment with hot water the fat of the refuse from its solid constituents. Professor Rubner has estimated the quantity of fat going to waste in towns at 20 grammes (0·7 oz.) per head per diem. If it is assumed that only one-quarter of this fat could be recovered from kitchen refuse, it represents a very large value. Such fat is in great demand for the manufacture of soap and lubricating oils, and in normal times fetches £20 to £25 per metric ton, and now more than three times that value. An indirect advantage of the washing of kitchen refuse with hot water for the extraction of fat is that there is at the same time matter removed from the fodder that is injurious to animals—such as pickling liquor and salt, and metallic, glass, and earthenware particles. These particles sink to the bottom in the washing process.

In regard to the utilization for the extraction and drying process of the waste heat in works, gas-works are specially indicated, because the waste gases from the retort-settings or regenerators are not merely free from smoke and ash but in them combustion is nearly complete, while the proportion of oxygen is small. They have the high temperature of 550° to 650° C. (about 1020° to 1200° Fahr.); and the large quantity of heat represented thereby has hitherto been completely dissipated in the open air. For instance, the Berlin Corporation Gas-Works, in the year 1913, carbonized about 917,000 metric tons of coal, from which about 70 per cent. (or 640,000 metric tons) of coke was produced. Of this coke, about 14 per cent. (viz., 130,000 metric tons) of the weight of coal carbonized was used for heating the retorts. Purely for gas production only one-half of the heat from this amount of coke is required. Consequently, the rest—viz., the heat from 65,000 metric tons of coke—has hitherto escaped utilization. Berlin (exclusive of the suburbs) has now a population of 2,071,000; and, with the ample allowance of 250 grammes (0·55 lb.) of concentrated kitchen refuse per head per diem, it can be shown that in the slackest period of the summer months the waste heat from gas-works would fully suffice to produce a concentrated fodder by drying the refuse. The increased gas production of the autumn would admit of large quantities of potatoes being converted by drying into potato cake, which can be stored indefinitely, and has been shown to have a high value as human and animal food. At the same time the waste heat of gas-works could be utilized for drying industrial refuse which might serve as food—such as the large quantities of spent grain and malt sprouts from breweries.

In Greater Berlin, with 3½ million inhabitants, there are also the English Gas-Works and a number of others in addition to those of the Berlin Corporation. The circular of the Prussian Ministers was sent to all Prussian towns having a population of 25,000, and therefore aggregating about 20½ million inhabitants, corresponding with a production of kitchen refuse from which a quarter of a million metric tons of dry fodder might be recovered. The whole of the 1335 German gas-works carbonized in 1914 about 10½ million metric tons of coal; and of the coke consumed in them for the heating of retorts it is estimated that the heat from three-quarters of a million metric tons has hitherto remained unutilized. In the larger towns the waste heat of gas-works could be utilized for the treatment of kitchen refuse, and in country places for the desiccation of potatoes, turnip cuttings, leaves, &c. Being commonly owned by the local authorities, there would be no difficulty in arranging for gas-works to undertake this work: and their railway or water connections would facilitate the reception of the refuse and the delivery of the products obtained from it. The local authorities would have to enforce rigidly on householders the segregation of kitchen refuse from ashes, &c. Figures produced by a Tegel firm of engineers show that, even after the end of the war, a good return should be obtained on plant for the utilization of kitchen refuse if erected on gas-works.

NITRE CAKE FOR SULPHATE OF AMMONIA MAKING.

The trouble with regard to price and deliveries of sulphuric acid for sulphate of ammonia manufacture has led to the suggestion that nitre cake should be substituted. The proposal was referred to by Mr. G. Stanley Cooper, B.Sc., in the paper read before the Coke-Oven Managers' Association, as published in our columns last week (p. 475). He mentioned at the same time that circulars had been issued on the subject by the Ministry of Munitions; and it was clear that Mr. Cooper is not enamoured of the substitute. The circular says that the sulphate produced by this method will contain 15·4 per cent. of sulphate of soda—thus reducing the ammonia content down to about 18 per cent.; while the free acid will be 1·4 per cent. What about bags with this acid content? Some years ago, Mr. Cooper experimented with nitre cake for this purpose; but he could never reduce the sulphate of soda down to anything like 15 per cent. He does not think that in the hands of an ordinary sulphate man anything like this figure can be attained, or continuously maintained. In further comments Mr. Cooper said: "The principal questions that arise are: (1) Can the mixed sulphate be sold? (2) How will the wear and tear of plant be affected? The first of these questions is, presumably, ignored by the Government; and the second is very lightly passed over. To my mind, it is an open question whether it is better to adopt this method or to make as much sulphate as possible by the ordinary process, and waste the rest of the ammonia, or recover it in some other form. I do not think the process is at all suitable for either direct or semi-direct plants, as to work these with the liquor at boiling-point would be highly detrimental. On the other hand, if the temperature is below boiling-point, an excessive amount of sulphate of soda is deposited. The process certainly cannot be launched into general practice in the off-hand manner which the Government circulars suggest."

The circulars referred to are as follows:

USE OF NITRE CAKE IN PLACE OF SULPHURIC ACID.

Transport.—It has been arranged for nitre cake to be delivered, for the present, free on rail at all of H.M. factories where it is produced. Manufacturers should, if possible, make their own arrangements for obtaining supplies; but the representative Committee appointed by the Ministry of Munitions to assist manufacturers in the West Riding of Yorkshire should be applied to in case of need. The Secretary of this Committee is Mr. A. Bebbington, West Riding Rivers Board, Wakefield. The Yorkshire Committee deals with supplies only for the West Riding; and manufacturers in other districts should apply to the Ministry of Munitions, Department of Explosives Supplies, Storey's Gate, London, S.W. With regard to cartage, the acid in the nitre cake will act injuriously on the woodwork, and on iron bolts in carts. These should, therefore, be protected with a coating of tar or bitumen, or be painted with silicate of soda.

Storage.—The cake should be stored under cover, as it is deliquescent; and any rain falling on it would yield an acid drainage, very liable to injure the foundations of walls and buildings. The floor of the storage room should be asphalted, or of stone, the joints of which are rendered in asphalte. This floor should drain to a catch-pit where any acid can be caught for use, or it should drain into the tank in which a solution is subsequently to be made. For small quantities, a lead-lined storage tank would be suitable and inexpensive.

Handling.—Nitre cake should be handled as little as possible, as it is very injurious to workmen's clothes and hands. If it is necessary to handle it, the workmen's clothes should be protected by sacking, and oil or grease should be provided for the protection of their hands. Boots will be injured if the workmen constantly tread on nitre cake.

Quantity to be Used in Place of Acid.—As the cake contains 30 per cent. of its weight of sulphuric acid, it must be used in quantities about three times greater when being substituted for B.O.V., and about four times greater when being substituted for D.O.V.

Sud Cracking.—For cracking suds in order to recover grease, the best method of using the cake is to dissolve it in hot water by the aid of steam, in a wooden or cast-iron vessel, and to use this solution while still hot. If equal weights of cake and water are used in preparing this solution, it is usually only about one-sixth as strong as B.O.V.; so if it has been usual to carry the B.O.V. in buckets, it would be advisable to install a small steam-ejector to raise the solution. Such an ejector should be constructed of antimonious lead, and placed below the level of the solution, so that it may always remain charged. The pipes for conveying the solution should be of lead. For small quantities, a lead-lined wooden tank would be suitable and inexpensive for the preparation of the solution.

At works where steam is not available at the grease extraction plant, the nitre cake can be packed in the troughing leading to the seak tanks, so as to be dissolved by the suds as these flow into the tanks. If the troughs are not long enough, they can be supplemented by wooden shoots reaching nearly to the bottom of the tanks, and packed with pieces of nitre cake. The final quantities of nitre cake necessary to finish off the cracking process may be added in the form of a solution prepared as above on some part of the premises where steam is available.

TECHNICAL DETAILS CONCERNING THE SUBSTITUTION OF ACID BY NITRE CAKE IN MANUFACTURING SULPHATE OF AMMONIA.

In those cases where the continuous process is in operation, and where the salt is fished or blown as frequently as allowable, by the operations of centrifuging, experiments have been carried out on the large scale for this department. At small works where the intermittent system is in operation, the conditions of working are at present under investigation; but there seems no reason to doubt that the process will prove equally successful in such cases also.

Nitre cake cannot be substituted for the whole of the sulphuric acid used in any of the ammonia absorption plants; but it is quite practicable to employ a solution of nitre cake admixed with acid without necessitating any alteration to the existing plant. The ammonia content of the salt is thus reduced from 25 per cent. to 18 or 20 per cent.

For commencing the operation, a solution of nitre cake is made in a lead-lined tank by the aid of steam. This solution, if made with about equal weights of water and nitre cake, will contain from 15 to 20 per cent. of sulphuric acid. It is fed into the saturator along with chamber acid in the proportion of two parts by weight of the solution and three parts of chamber acid.

The bath will now have an acidity of 40 to 50 per cent., and a density of about 86° Twaddel at 200° Fahr. But the density does not afford a satisfactory indication of the strength of the bath, which should be frequently tested by titration, and maintained at about 6 per cent. acidity by adding fresh quantities of nitre cake solution and chamber acid mixed in about equal quantities.

The first yield of salt contains a large proportion of sulphate of soda; but a salt of the required composition is soon obtained if the bath is kept at boiling point and its acidity maintained at 6 per cent. If the bath is allowed to cool, sulphate of soda separates out.

It is important that the nitre cake used should contain only a very small quantity of nitrate, since any large amount of nitric acid liberated in the saturator would have a deleterious effect upon the plant.

The salt produced contains about 18 to 20 per cent. ammonia on the wet basis. On the dry basis, the average of several analyses of the salt is:

Ammonium sulphate	83·2	per cent.
Sulphate of soda	15·4	,,
Free acid	1·4	,,

By the general adoption of this process, it is estimated that 15 to 25 per cent. of the sulphuric acid now used for the production of sulphate of ammonia could be replaced by nitre cake. The amount of acid thus liberated for use in explosive works would amount to 1200 to 2000 tons of B.O.V. per week.

As ordinarily produced, 2½ tons of nitre cake contain as much acid as 1 ton of B.O.V. But owing to the lower price at which the acid in nitre cake can be bought, calculating on the basis of pure sulphuric acid, it is estimated that the process will effect a considerable saving.

The "Scottish Gas Industry" Ambulance Car.—We are informed by Mr. P. B. Watson, of Wishaw, the Secretary and Treasurer of the North British Association of Gas Managers, that there were 184 subscriptions (totalling £411 7s. 1d.) towards the motor ambulance car which was last month presented [*ante*, p. 301] to the Scottish Branch of the British Red Cross Society, at Glasgow. The disbursements were: Cost of motor ambulance car, £400; stationery, printing, and postage, £5 3s.; balance sent to the Red Cross Society for the Maintenance of Ambulance Cars Fund, £6 4s. 1d.

THE NAPHTHALENE DISCUSSION AT THE MANCHESTER INSTITUTION MEETING.

It will have been noticed from the report of the discussion on Mr. Henry Simmonds's "Naphthalene" paper at the meeting of the Manchester Institution District of Gas Engineers, in last Tuesday's "JOURNAL," that our representative failed to gather the purport of the remarks made by Mr. R. G. Shadbolt, of Grantham. On our suggestion, Mr. Shadbolt has since forwarded the following communication, which enables the omission to be made good.

Mr. SHADBOLT says: "My experience with tar-washing in warm summer weather corroborated that of Mr. Leather, inasmuch as it greatly increased the naphthalene content of the gas when the temperatures of gas and tar could not be kept down. I have found relief by circulating water from a gasholder tank through the condensers; the temperature of this water in the hot weather, at a depth of 15 feet being, about 20° Fahr. lower than that on the surface. Two months' circulation only increased this temperature, at 15 feet down, by 4° Fahr. (tank 51 feet diameter, of brick, and buried in ground). I threw this out as a possible solution to those who seemed inclined to advocate dropping tar-washing in hot weather, as a means, ready to hand, in many cases. A private conversation I had with Mr. Simmonds at the close of the meeting, had reference to his estimated cost, which I pointed out to him was incorrect, as he had credited the system with the volume of 'aerated mist' at the selling price of his gas, instead of the cost price of his gas. I suggested that he should correct the cost claim in his paper accordingly; but I see he has not done so, which is a pity, as it spoils a good case."

GAS FROM WOOD.

THE "Engineering Supplement" to "The Times" mentions that wood is in more or less constant use in many of the small Australian gas-works. Only certain classes of timber are suitable for the purpose; the best being those of the box and red-gum varieties, which are intermixed with coal to the extent of about 25 per cent. By introducing the wood, it is claimed that the resulting product offers many advantages over ordinary neat coal gas, chiefly owing to the fact that naphthalene troubles are almost eliminated, while there is some considerable reduction in the amount of scurf deposited on the retorts. In Australia it is found that the average yield of gas amounts to about 12,000 cubic feet per ton of wood carbonized; but the great drawback to the method of working is the charcoal which remains behind after the completion of the distillation. It is usual to separate the charcoal from the coke, and to make use of it for heating the retort-furnaces. As employed for power purposes, wood gas is invariably manufactured from waste material such as sawdust and shavings, or even leaves; and, except for the de-tarring and washing, it is consumed in the crude form, unmixed with any other gas. Suction plants designed for using wood waste are capable of working with material of any description between dust and lumps 6 inches diameter. In general, in addition to the generator, it is necessary to instal a condenser, washer, and tar-extractor, so that all the connecting-pipes to the engine may be kept perfectly clear. The moistness of the wood has an important effect on results; and in the event of the water content being greater than 60 per cent., preliminary drying should be resorted to, otherwise difficulties will be encountered with the fire. Wood gas as obtained by distillation in gas-works has a calorific value of about 400 B.Th.U. per cubic foot; whereas the gas generated by the suction plant is approximately 160 B.Th.U. The latter figure it will be noticed is, if anything, somewhat higher than the corresponding value of the gas obtained with anthracite producers. A successful method of using wood waste is that employed in the Brooks dual scheme. The wood is primarily carbonized in retorts in the ordinary way, when a gas equivalent to about 13,000 cubic feet per ton, and having a calorific value of from 375 to 390 B.Th.U., is obtained. The resultant charcoal, which amounts to one-fifth of the original weight of the wood, is then transferred to suction producers, and the mixed gas is employed for power purposes.

Illuminating Power of Gas.—At a recent meeting of the Manchester Literary and Scientific Society, Dr. H. F. Coward and Mr. F. Bailey described an experiment, having for its object the ascertaining of the chief source of the illuminating power of coal gas. A stream of coal gas was passed through a tube immersed in solid carbonic acid and ether at − 79° C. This condensed completely all the benzene, toluene, and similar substances, but it allowed the whole of the ethylene to pass forward with the gas. The luminosity of the flame of the issuing gas was very feeble in comparison with that of the original gas. Measurements carried out at the Manchester Corporation Gas-Works showed that a particular coal gas lost 78 per cent. of its illuminating power by this treatment. It was claimed that the benzene hydrocarbons contribute far more to the luminosity of coal-gas flames than does ethylene, in spite of the fact that the volume of ethylene present is usually from three to five times the volume of benzene vapour.

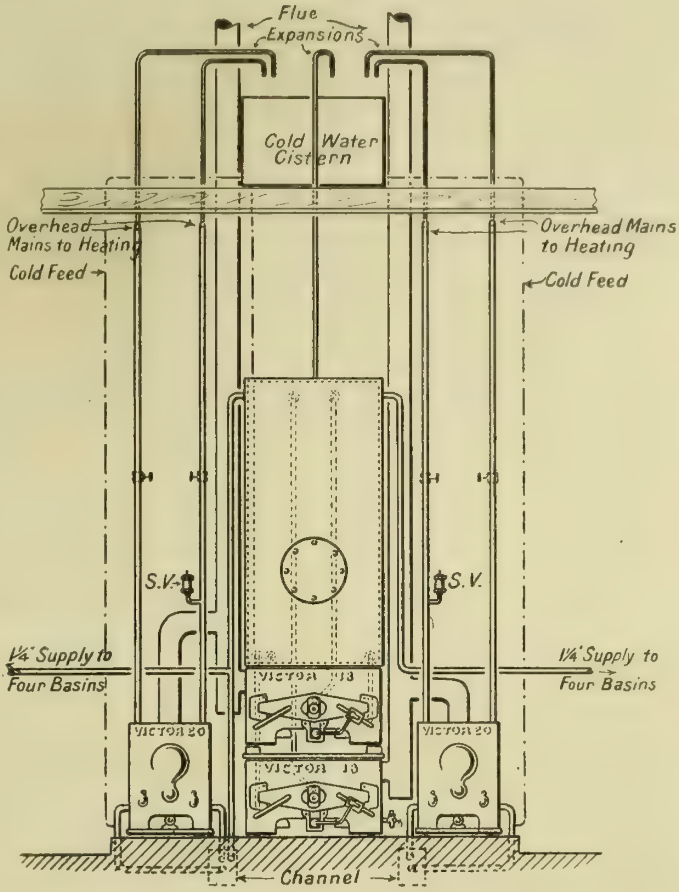
.WATER HEATING BY GAS FOR MILITARY CAMPS, MUNITION WORKERS, &c.

We are all concerned in military affairs nowadays, from recruiting, conscription, and munitions making, to work on the battle-field—and after. In the gas industry we are also deeply interested in the part that our primary and secondary products are taking in munitions making, and in promoting the comfort of the men and facilitating work in military camps, munition establishments, and other places associated with the great military system which has been brought into being through the war. Therefore, some notes on the equipment with water-heating apparatus (gas being used as the fuel) of certain accommodation centres, camps, hospitals, &c., as carried out by Mr. Thomas Potterton, of Balham, will prove of especial interest at this time. The notes show how large-scale work has been going forward in this direction of which there is nothing but local knowledge. We have in our possession the names of the localities in which the camps and other places are situated; but publication of the precise whereabouts is debarred during the war.

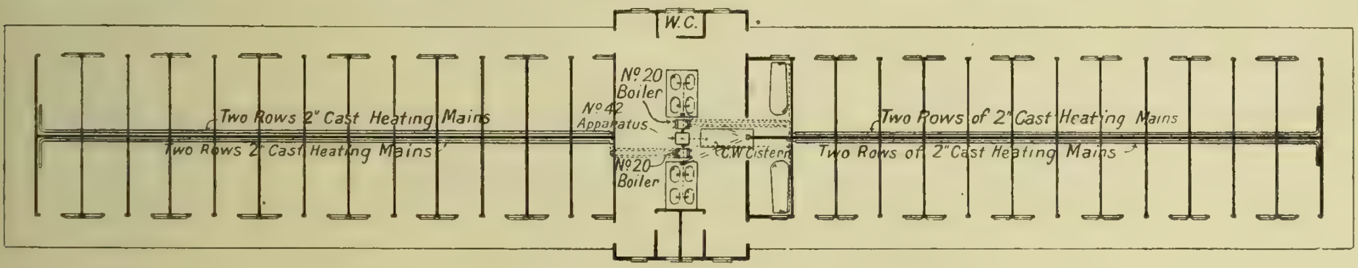
Hot-Water Installation at a Colony of Munition Workers.

First, attention is directed to Cheshire. There on a large estate a colony is being built (under the superintendence of the Architectural Department of the Y.M.C.A.) for the accommodation of 500 munition workers who are employed by a firm of considerable importance. In all ten huts are being erected, each containing fifty cubicles for sleeping, with central lavatory and bathrooms, as shown on the plan. In each hut a plant consisting of four "Victor" gas-boilers, with the necessary storage tanks and heating-pipes, is being installed, for the dual purpose of supplying hot water to the lavatory basins and baths, and warming the sleeping cubicles.

The elevation on the drawing shows the lay-out of the boilers and storage in the centre of the lavatory, between two sets of basins. For the bath and lavatory supply, a "Victor" complete automatic hot-water apparatus (No. 42 design) is adopted, comprising two No. 13 boilers, with storage tank of 70 gallons. This apparatus is fed from a shallow cold-water cistern formed in the roof timbers, which, by proportioning the cold-water service and hot-delivery pipes, gives ample pressure at the taps, even though working on the cylinder-system, which is essential to quick and efficient results.



Elevation of Apparatus in Lavatory.


W.C.
No 20 Boiler
No 42 Apparatus
No 20 Boiler
Two Rows 2" Cast Heating Mains
Two Rows 2" Cast Heating Mains
C.W. Cistern
Two Rows of 2" Cast Heating Mains
Two Rows of 2" Cast Heating Mains

Plan.

HOT WATER SUPPLY AND HEATING INSTALLATION FOR FIFTY-CUBICLE HUT FOR THE Y.M.C.A.

The baths are specially selected of moderate size to enable 20 gallons of water to serve for each man, and allowing for six baths being taken per hour—three in each case—the combination of boilers provided gives sufficient margin for the use of the lavatory basins, even though the demand occurs simultaneously.

Thermostatic control is provided at the boilers, to shut down the gas supply when a mean temperature of 140° Fahr. has been reached; and the two boilers in ordinary use will heat the storage to this point in one hour. The plant, being immediately adjacent to the lavatory basins, renders a secondary circulation unnecessary; while to the baths a short length of dead service is carried under the floor and carefully felted, thus reducing the secondary heat losses to the utmost extent.

For the purpose of warming the cubicles, an apparatus in two sections has been adopted; the heating surface consisting of four rows of 2-inch flow-and-return pipes carried throughout the building, about 12 inches above the floor-line. Two No. 20 "Victor" boilers are provided for working these heating mains—one for each half of the building. The connections are arranged upon the overhead system, in order to clear the gangways of the lavatory and bathrooms—the flows passing overhead near the ceiling-line; the returns being accommodated in specially formed channels in the concrete floor. The necessary air-vents are taken from the highest point of each circuit, and open-air pipes from the extreme ends of the apparatus; thus ensuring automatic action without attention to air-cocks or other means of venting.

It is anticipated that the heating of these cubicles will not be required constantly, as the men will be working alternate night and day shifts. To provide for the disconnection of any portion of the apparatus, control valves, with removable keys, are fitted in each case.

An administrative department is provided in connection with these huts for the accommodation of the male and female workers—a limited number of sleeping cubicles being provided for each—in order that those munition workers who start in the early morning, and breakfast at six o'clock, may have proper attention. A bath and lavatory are provided for each section—male and female; the hot-water supply being obtained from a No. 52 "Victor" complete apparatus worked as a local unit in each case, as the bathrooms are quite detached from any part of the colony where the other supplies exist.

The heating of the sleeping cubicles, staff sitting rooms, and offices are treated in a similar way to the munition workers' huts; being warmed by means of hot-water circulation from No. 20 "Victor" boilers.

This extensive installation therefore comprises 45 gas-boilers, ten cold supply and hot-water storage tanks, 6000 feet of 2-inch cast-mains and 2000 feet of wrought circulation; while the gas consumption for the whole plant will vary from 3600 cubic feet per hour, when the complete system is in full use, down to 250 cubic feet per hour when only half the gas-boilers for the hot-water supply are working under the thermostatic control.

Y.M.C.A. Soldiers' Huts—Somewhere in London.

In this instance, we have huts for soldiers at a sleeping centre in London. The water-heating plant here has been arranged for the supply of three baths and eight lavatory basins in the soldiers' quarters, and three sinks for the kitchen and scullery. The apparatus comprises four No. 20 "Victor" gas-boilers, and a 150-gallon storage tank, accommodated in a chamber between the bathroom and scullery, thereby reaching all points with a short length of service without secondary circulation. The building being of the bungalow type, the cold supply can only be taken from a cistern about 10 feet above the floor. But the supply and delivery pipes are proportioned to enable the apparatus to be worked upon the cylinder system; and to assist in this the storage is designed in rectangular form, thereby working at the lowest possible level. Two of the boilers are fixed to heat the whole of the storage provided; while the remaining two are connected with a cut-out valve, so as to be applied to the full storage or one-half of it when there is less demand for hot water.

Y.M.C.A. SOLDIERS' HUTS—ALSO IN LONDON.

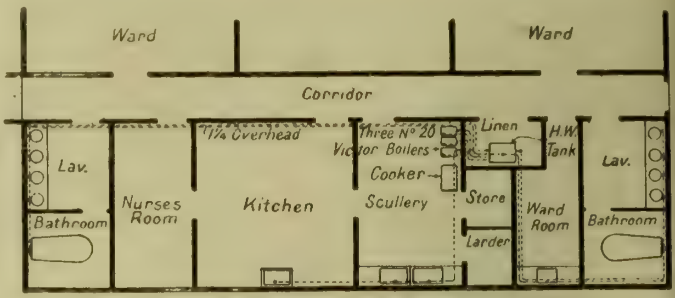
A similar plant to the one described above has been installed in this case, with three No. 20 boilers and 130-gallon cylinder for the supply of hot water to baths, sinks, and lavatories.

V.A.D. HOSPITAL—SOMEWHERE IN KENT.

In this case, the plant, as the drawing shows, consists of three No. 20 "Victor" gas-boilers, with a 100-gallon storage tank, for the supply of hot water to two baths, eight lavatory basins, and four sinks.

The plant in this instance is designed in central form, serving the whole of the requirements as one unit; and, in the circumstances, a secondary circulation is desirable to reach approximately to the points requiring hot water. All parts of the apparatus, however, are covered, to prevent loss of heat where the emission does not answer a useful purpose. An airing-room for linen was required; and in order to provide warmth for this, the hot-water storage is fixed in the cupboard, where constant heat will thereby be maintained. Night valves are fixed on the returns of the two secondary circulations; so that, when the baths and lavatories are not in use, the long circulation necessary for the purpose can be shut off, and thus economize gas consumption.

The heating is performed by three No. 20 "Victor" boilers, burning 80 cubic feet of gas per hour each, which will heat the storage in sixty minutes under normal conditions. To provide for a reduced supply when the baths are not required, or only a small demand for hot water occurs, Potterton's cut-out valve has been adopted in connection with the hot-water storage.



Plan.

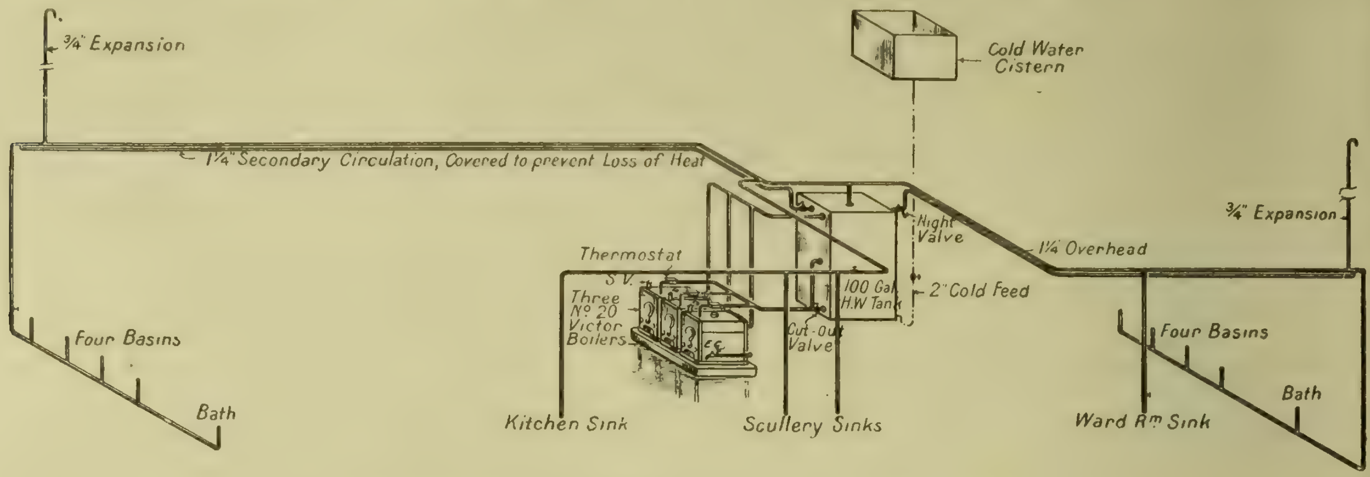
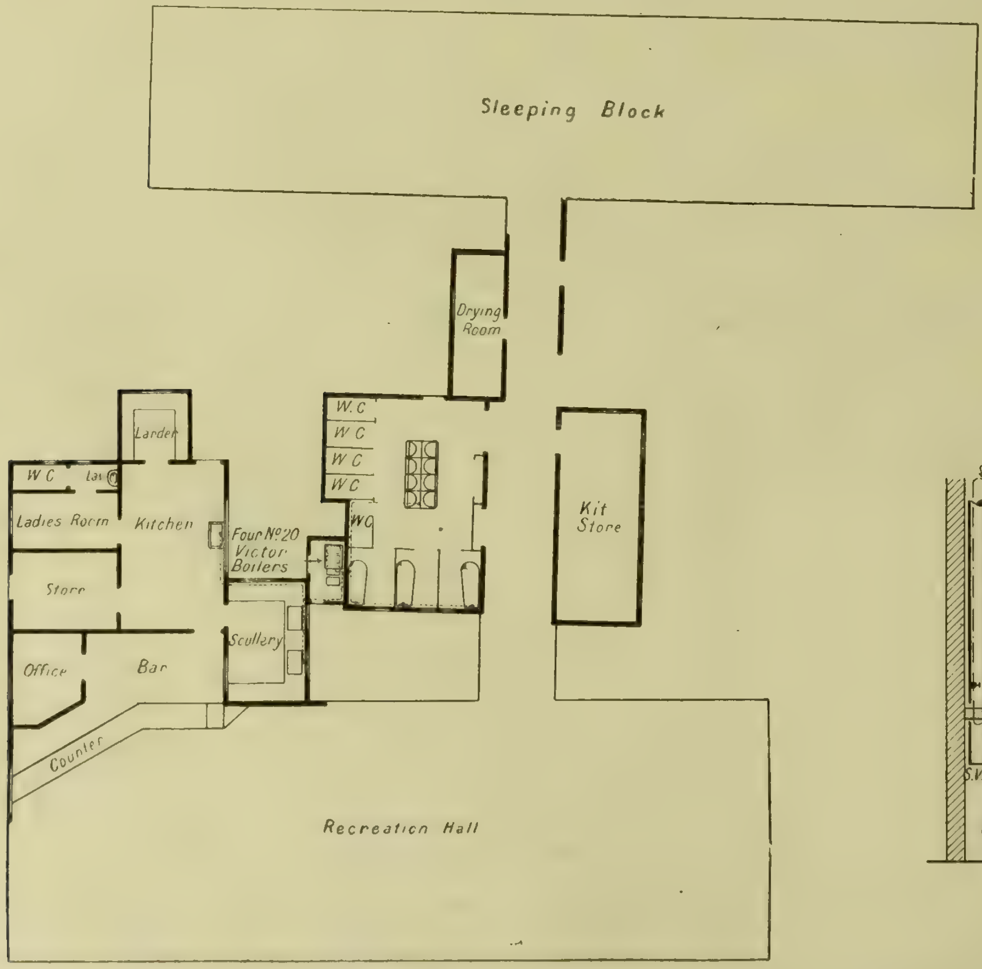


Diagram of Apparatus.

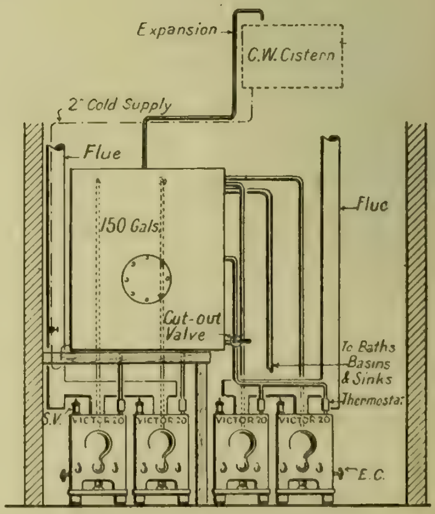
DOMESTIC HOT-WATER SUPPLY SERVICE AT A "V.A.D." HOSPITAL.

OFFICERS' QUARTERS AT A CAMP IN SUSSEX.

Central heating plant was required in this instance to supply hot water to eight baths in addition to lavatories, kitchen, and scullery sinks, for the requirements of eighty officers resident in the camp. The baths were equally distributed throughout the



Plan.



Elevation of Apparatus.

HOT WATER SUPPLY APPARATUS FOR A "Y.M.C.A." HUT AT A SOLDIERS' SLEEPING CENTRE.

building to serve the cubicles in sections; and this necessitated circulations being carried a considerable length.

The plant consists of six No. 20 "Victor" gas-boilers with 300-gallon storage tank; the boilers being connected in two series of three—the one heating two-thirds of the storage capacity and the other the whole.

Y.M.C.A. Munition Workers' Huts in Essex.

Here we have three plants for the supply of hot water to baths and lavatories, comprising No. 42 "Victor" complete apparatus, with two No. 13 boilers, and 70-gallon storage cylinders for the purpose of supplying six baths and fourteen lavatory basins.

Y.M.C.A. Soldiers' Club in London.

A theatre has been adapted as a Soldiers' Club. In the building a "Victor" gas-heated hot-water supply apparatus originally existed for the supply of the artistes. To render the theatre suitable for the Y.M.C.A. Club purposes, three baths were required for the soldiers' use, for which the existing system was naturally inadequate. The capacity of the storage is 60 gallons; and by the addition of two No. 20 "Victor" gas-boilers to work in conjunction with the existing boiler, this storage has been retained, and is found ample for all requirements. The three boilers, working in conjunction, heat the apparatus with such rapidity that, when a succession of baths is required, there is no shortage, notwithstanding the small capacity of the storage.

For the purpose of the kitchen (which is quite remote from the baths, and is in fact on another floor), a No. 21 "Victor" complete apparatus has been fitted to supply hot water for washing-up purposes. This plant is fitted upon the "push-out" system off the existing cold-water supply, in order to avoid the necessity of long service and expansion pipes from and to the main cold-water supply cistern.

"Third London" Hospital.

This is a large installation. Upwards of forty sets of the "Victor" complete apparatus have been adopted for the bathrooms in the hospital wards.

Although we have particulars of other important water-heating installations that have been made by Mr. Potterton in which gas is the fuel employed, the foregoing examples suffice for showing the character of the work that has unostentatiously been going forward, in connection with the war, not only at camps, hospitals, sleeping centres, &c., but in connection with drying apparatus for munition factories and the manufacture of explosives.

ATMOSPHERIC POLLUTION.

A supplement to the "Lancet" for Feb. 26 contained the first report of the Committee appointed for the investigation of atmospheric pollution. The report extends to forty pages, and comprises much letterpress, eighteen maps of the districts where observations have been made (with the positions of the standard gauges marked), and much tabular matter giving the results of analysis. There are fourteen members of the Committee—viz., Mr. C. J. P. Cave (Past-President of the Royal Meteorological Society), Mr. J. G. Clark, Professor J. B. Cohen, B.Sc., Ph.D., F.R.S. (Leeds University), Dr. H. A. Des Vœux (Coal Smoke Abatement Society), Dr. Hawkesley (Assistant Medical Officer of Health, Liverpool), Mr. J. B. C. Kershaw, F.I.C. (Hamburg Smoke Abatement Society), Dr. Rudolf Lessing, F.C.S., Dr. J. S. Owens (Coal Smoke Abatement Society), Dr. E. J. Russell (Director of the Rothamsted Experimental Station, Harpenden), Sir Napier Shaw, Sc.D., LL.D., F.R.S. (Director of the Meteorological Office), Chairman, Mr. E. D. Simon (Smoke Abatement League of Great Britain), Bailie W. Smith (Convener of the Air Purification Sub-Committee of the Glasgow Corporation), Mr. S. A. Vasey, F.I.C., F.C.S. (the "Lancet"), Mr. F. J. W. Whipple (Superintendent of the Instruments Division, Meteorological Office). This Committee is supplemented by several correspondents and analysts. A standard gauge was made for collecting the atmospheric impurity which falls on an exposed surface, together with that which comes down with the rainfall. With the co-operation of the authorities of nineteen cities, gauges have been installed, and provision made for analysis of collected products. They have also under consideration a filter designed by Dr. Owens to measure from hour to hour the amount of solid pollution in the atmosphere.

What is Air Pollution?

Coming to the more material matter and the observations themselves, we have the preliminary statement that normal air may be regarded as consisting of a mixture of various gases in the following proportions:

	Per Cent.
Oxygen	20·94
Nitrogen	78·09
Argon	0·94
Carbon dioxide	0·03
Helium, krypton, neon, &c.	Traces
	100·00

In addition to these gases, there exists a quantity of water vapour, varying according to certain well-known physical conditions. The term "pollution" in its widest sense may be regarded as applicable to anything that disturbs the above-described constitution of the air. For instance, an excess of the watery constituent, represented by excessive rain or an abnormal quantity of carbonic acid, may be regarded as pollution. But these constituents need no further consideration. The Committee's interpretation of the term "pollution" relates to such matter, solid, liquid, or gaseous, as reaches the surface of the earth or falls upon the buildings, &c., either by its own gravity or with the assistance of falling rain.

Solid Pollution.

The atmosphere, as we know it from everyday experience, contains suspended solid matter which cannot be regarded as a normal part of its constitution. Its significance from the physiological point of view is realized when we remember that an adult human being inhales about 400 cubic feet of air per day. Much of the solid pollution consists of combustible sooty matter; and this constituent is the source of much trouble in towns. A member of the Committee made a chemical analysis of the matter intercepted by the ventilator filters of a large institution in London, with the following results:

	Per Cent.
Sodium chloride	Trace
Calcium carbonate	2·17
Ferric oxide	2·44
Calcium sulphate	5·09
Alumina	8·34
Magnesium carbonate	0·33
Sand	37·99
Carbon	35·48
Ammonium sulphate	5·77
Tar (extracted by CS_2)	1·49
Fibrous matter	0·95
	100·05

The large proportion of free carbon in the suspended matter clearly explains the dirtying effects that are too obvious in our towns and cities; but, in addition, there are sulphates present, the effect of which on building stones is notorious. In the matter alluded to in the above analysis the sulphur takes the form of calcium sulphate, ammonium sulphate, and a very minute quantity of free sulphur; the latter probably having its origin in the oxidation of sulphuretted hydrogen evolved from the imperfect combustion of raw coal.

The following two partial analyses (made by a member of the Committee) indicate the chemical character of soot from bituminous material; in each case the fire was of the domestic type:

	Sample No. 1. Per Cent.	Sample No. 2. Per Cent.
SO_3	6·2	5·8
H_2O	4·4	4·0
CaO	1·4	2·5
Fe_2O_3	2·2	2·5
Cl	7·7	7·9
Ether extract (tar)	28·6	17·7
NH_3 (combined)	4·7	3·8
Other constituents	44·8	55·8

The matter that passes through the chimney into the atmosphere in the form of smoke would be similar in its chemical character to the soot, except that there would be in addition a considerable quantity of noxious gases and vapours. In one case the following constituents were found in the smoke passing through a chimney under which a domestic coal-fire was burning:

Formaldehyde	3·94 parts per 100,000
Sulphuretted hydrogen	51·35 ,, ,, ,,
Carbonic oxide	1·55 ,, ,, ,,

Having regard to the large volume of air that usually passes through a coal fire chimney, these proportions are significant. The first two ingredients would probably undergo oxidation in the air, especially in the presence of sunlight. In addition to these three gaseous impurities, other gases, such as sulphur oxides and ammonia, together with carbonic acid, were present in very large quantities, but were not estimated. There can be little doubt that similar results obtain when coal is imperfectly burned in steam-boilers, or in works where coal is used for purposes other than steam-raising.

Vaporous and Gaseous Pollution—Innocuous Gaseous Methods of Heating.

The vapours to which the attention of the Committee has been given were the tarry hydrocarbons. This tarry matter attaches itself to the carbon particles and gives them very great adhesive power, so that when they have deposited on, and attached themselves to, building stones, plant, &c., they cannot be readily washed away by rain, as would be the case if the tar were not there.

The gaseous pollutions kept in mind by the Committee were the sulphur oxides and ammonia. Coal contains on the average about 1 per cent. of its weight of sulphur (say, 20 to 30 lbs. for each ton of coal). Under conditions of perfect combustion, this sulphur would be evolved as either di-oxide or tri-oxide of sulphur or both. But if the combustion is not perfect, sulphuretted hydrogen appears—in fact, it is probably always safe to assume that when visible smoke is evolved from coal, sulphuretted hydrogen accompanies it.

The Committee recognize that during recent years many thousands of smoke-producing coal-fires have been supplanted by gas cooking and heating stoves, and, still more recently, the electric stove has been introduced. The products of combustion from a gas-fire consist mainly of carbonic acid and water vapour, together with a minute quantity of sulphur oxides. There is a total absence of those tarry and carbonaceous substances that are produced by the use of raw coal; and as the sulphur is so exceedingly small in amount, the gaseous method of heating is comparatively innocuous. As regards heating capacity, a coal-fire consuming 21 lbs. of coal per day would be about equal to a gas-fire consuming 200 cubic feet of gas per day; but whereas the coal would evolve about 1500 grains of sulphur in various forms, as well as the tar, carbon, &c., already alluded to, the gas would contribute only 50 to 60 grains of sulphur in the form of sulphur oxides. Electric stoves do not evolve products of combustion; and therefore their use also tends to a cleaner air.

Apart from the polluting effect of the 20 to 30 lbs. of sulphur for each ton of coal consumed, it is regrettable that this valuable material should be wasted. Its total amount must be huge. The Committee recognize that much of this waste of material is avoided when coal is utilized in gas-works.

A SAMPLE TABLE.

The methods of work pursued are next explained, and then the standard gauge is described, and instructions follow. Succeeding are the maps and tables—referring to Birmingham, Bolton, Exeter, Kingston-upon-Hull, Liverpool, London, Malvern, Manchester, Newcastle-on-Tyne, Oldham, Sheffield, York, Coatbridge, Greenock, Leith, Paisley, and Stirling. This is a really representative geographical collection of places for the observations. One out of three tables for Birmingham will give an idea of the extensive character of the work involved, and the value of the whole of the data to those who are concerned in atmospheric pollution, and its reduction by the adoption of non-smoke producing means of heating.

deal with the acids and salts dissolved in the rain water which are included in the products of combustion of coal. The loss on ignition is due to the soluble organic matter, ammonia salts, and carbonates of the alkaline earths. The sulphuric acid referred to is included in the soluble portion. The chlorine may get into the atmosphere in the form of chloride of sodium from the spray of sea water. Ammonia is produced with tar by destructive distillation in the combustion of coal and decay of animal refuse.

COMPARISONS.

Commenting on an extensive table showing the monthly means of the several elements of pollution, the Committee note (among much else) that in Manchester the School of Technology, with six months' record, gives the same results as the University, not far away, with only one. Davyhulme and Fallowfield are similar, except that Davyhulme gets the better mark for tar. Fallowfield and Moss Side are similar, except that there are more of the soluble constituents and acids at Moss Side. Similarly, Bowdon makes a very exemplary record, but gives way to Malvern, particularly in the matter of acids. Birmingham Central is almost identical with Sheffield (Attercliffe); but Birmingham has more sulphuric acid in its air and Sheffield much more chlorine. Leith and York run entirely together, until the ammonia column is reached. Tar and other carbonaceous matter do not follow one another very closely. The insoluble ash is relatively prominent at Liverpool, the Meteorological Office, and Wandsworth Common, but relatively inconspicuous at Embankment Gardens, Southwark Park, Golden Lane, in Central Manchester (School of Technology and University), Newcastle-on-Tyne, Paisley, and Stirling. This deposit includes wind carried dust, and is therefore a good deal dependent on the exposure of the gauge. Sulphuric acid is generally in the same proportion as the total solids; the agreement is quite striking. The exceptions are Bolton, London (Victoria Park), Manchester (Whitefield), comparatively richer in acid, Newcastle-upon-Tyne, Oldham, Sheffield (Attercliffe), and Paisley comparatively poorer. Chlorine is rather more irregular, and is relatively conspicuous by its presence at the Meteorological Office, Sheffield (at Attercliffe and Meerbrook Park), Greenock, and Paisley.

BIRMINGHAM (CENTRAL).

—	Rainfall in Millimetres.	Metric Tons per Square Kilometre.								
		Insoluble Matter.			Soluble Matter.		Total Solids.	Included in Soluble Matter.		
		Tar.	Carbonaceous other than Tar.	Ash.	Loss on Ignition.	Ash.		Sulphate as (SO_4).	Chlorine (Cl).	Ammonia (NH_3).
1914.										
May	35·60	0·18	4·79	15·92	1·71	7·26	29·86	2·99	1·57	0·48
June	54·36	0·2	4·48	11·76	1·96	4·7	23·1	2·36	1·20	1·36
July	99·0	0·20	4·80	12·20	1·40	5·70	24·30	2·60	0·80	0·20
August	55·0	0·10	2·50	7·50	0·90	3·20	14·20	1·70	0·30	0·10
September	22	0·10	2·80	8·50	1·30	3·40	16·10	2·10	0·20	0·10
October	39	0·12	4·36	12·37	1·54	4·81	23·20	2·72	0·31	0·09
November	86	0·11	4·17	10·05	1·47	6·30	22·10	3·66	0·52	0·05
December	158	0·56	5·36	15·42	2·53	10·42	34·29	5·52	1·10	0·13
1915.										
January	72	0·15	5·29	13·16	2·70	7·00	28·30	4·40	0·60	0·04
February	89	0·19	3·04	7·57	1·60	5·80	18·20	3·60	0·60	0·07
March	20	0·12	3·90	12·38	1·30	4·20	21·90	2·60	0·40	0·03
Total	729·96	2·03	45·49	126·83	18·41	62·79	255·55	34·25	7·60	2·65
Monthly mean	66·36	0·18	4·14	11·53	1·67	5·71	23·23	3·11	0·69	0·24

ELEMENTS OF ATMOSPHERIC IMPURITY.

In this first report upon such an intricate and elaborate investigation, the Committee say it is too much to hope that the figures are entirely devoid of error. The analysis of atmospheric pollution has necessarily been guided by the facilities of chemical analysis to separate the different constituents of atmospheric impurity. The elements evolved are:

(1) Tar and other carbon compounds soluble in carbon bisulphide.
(2) Carbonaceous matter which is not soluble in that reagent.
(3) Ash which is included in the residue after the first filtration.
(4) Loss on ignition—*i.e.*, the volatile and combustible parts of the compounds dissolved in the rain water.
(5) Residual ash from these compounds—after the ignition.

These five together make up the total solids collected in the gauge. A separate estimate is made of the amount of sulphates as SO_4, of chlorides as Cl, and of ammonia as NH_3.

With reference to these elements, it may be noted: (1) The tar in the atmosphere is produced by the imperfect combustion of coal or wood and, recently, by the introduction of the practice of tarring roads; (2) the carbonaceous matter other than tar may consist of coal dust or of unconsumed carbon carried into the atmosphere by draughts through fires, also any fragments of animal or vegetable matter, animal refuse, pollen, and blown seeds; (3) the insoluble ash includes the dust of mineral origin carried from roads or open country by the wind; and (4) and (5)

THE ORDINARY AIR WE BREATHE.

It is therefore interesting to observe that the average atmosphere may be expected to deposit upon a square kilometre in any one winter month 15 tons of solid matter, which may be regarded as made up of 0·15 ton of tarry matter, 3 tons of carbonaceous matter other than tar, 6 tons of insoluble inorganic dust, besides soluble salts, which include 3 tons of sulphuric acid, 1 ton of chlorine, and 0·3 ton of ammonia. Taking 250 acres to the square kilometre, 1 ton per square kilometre works out at rather less than 1 cwt. to 12½ acres, or 9 lbs. per acre.

RELATION OF POLLUTION TO THE SEASONS.

At the end of the report the question is considered of the relation between the various elements of atmospheric pollution and the season of the year. It was expected beforehand that there would be a relation, because the products of pollution by domestic fires is one of the most noteworthy characteristics of the colder seasons. Several tables follow. A seasonal variation with a maximum in winter and a minimum in summer is clearly disclosed in the summary for total solids. The same characteristic is emphasized in soluble ash and even more so in sulphuric acid; and to a less extent also in loss on ignition and also in tar. Spring is the most productive of grit; summer and winter are equal in this respect; and autumn is least. Carbonaceous matter other than tar (smuts and fragments of plants) shows no discrimination between the seasons. Ammonia is the only one which shows itself as a summer product.

THE EVOLUTION OF THE MODERN CHARGING AND DISCHARGING MACHINE.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

[*Continued from p. 463.*]

Type and Rating of Motors.

The motors used on the machines referred to in last week's article are usually of the series-wound type; and, so far as their characteristics are concerned, are identical with the motors used on street tramway systems. Automatic speed regulation is not essential to the successful operation of these machines (with the exception of the case of projector machines), while the high initial torque which the series-wound motor is capable of exerting renders it a particularly suitable machine for the handling of loads possessing a considerable degree of inertia which has to be overcome. Some makers favour the practice of adding a sufficient number of shunt turns to a standard series machine to keep down the light load speed to reasonable limits; but in view of the fact that the operator has perfect control over the speeds of all his motions, it is doubtful whether this practice confers sufficient benefits to warrant the extra expense and the increased electrical complication.

These motors are invariably rated upon an intermittent basis—that is to say, upon a basis which takes into account those periods during which the motor is standing idle, and in which, as a consequence, it has plenty of time to cool. Broadly speaking, where a motor is run constantly for periods of two or three hours it should be rated upon a continuous basis; but for any lesser periods, and for work in which a perfectly regular periodicity or degree of intermittency exists between the idle and the working periods of the motor, the machine may be rated upon the intermittent basis. This rating is expressed as a fraction of a percentage existing between a given time and the period in that given time during which the motor is working at or near full load. For example, a crane-lifting motor may be working at full load for one minute and then standing for two minutes while the suspended load is being handled by the slewing or travelling motors. In such a case the intermittency factor of this motor would be one-third, or 33 per cent., if we take no account of the lowering time, when in any case the motor would be very lightly loaded. This factor may also be expressed as the output at which a motor will work for one hour with a given rise of temperature.

For discharging and travelling on a retort charging or discharging machine using separate motors, the motors employed on these motions will have a higher rating than that used on the lowering-hoisting motion; while in the case of a single-motor machine, it is obvious that a continuous rated motor should be employed if the stoking machine is to be used continuously, as the idle intervals of the motor will be much too short to warrant the use of an intermittent rated machine.

The following table shows the horse power and the speeds at which a "KA 7" type motor, manufactured by the British Thomson Houston Company, of Rugby, will operate on a 220 volt circuit for a quarter, half, and one hour duty with temperature rises of 40°, 50°, 60°, and 70° C.:

Rating.	Horse Power.	Speed R.P.M.	Temperature Rise.	
			C.	Fahr.
Quarter hour	12·5	480	40	72
,, ,, ...	14·0	450	50	90
Half hour	10·3	545	40	72
,, ,, ...	11·5	510	50	90
,, ,, ...	12·5	490	60	108
,, ,, ...	13·5	465	70	126
One hour	8·0	635	40	72
,, ,, ...	9·0	585	50	90
,, ,, ...	9·8	560	60	108
,, ,, ...	10·5	540	70	126

The momentary overloads of which this machine will be capable of handling in excess of the normal rating expressed on the above basis will be as follows:

Temperature Rise after Run at Normal Rating.		Momentary Overload.		
		Quarter Hour Duty.	Half Hour Duty.	One Hour Duty.
C.	Fahr.	Per Cent.	Per Cent.	Per Cent.
40	72	75	100	100
50	90	75	100	100
60	108	—	75	100
70	126	—	75	100

The machines to which these figures refer are particularly suited for this class of work, and are made in eight sizes by the British Thomson Houston Company. The following table gives the various capacities and speeds of these eight sizes, based on a temperature rise of 40° (72° Fahr.), after runs of quarter hour, half hour, and one hour durations on a 220 volt circuit:

—	B H.P. Quarter Hour.	R.P.M.	B.H P. Half Hour.	R.P.M.	B.H.P. One Hour.	R P.M.
K.A. 4	3·9	600	3·1	700	2·4	850
K.A. 5	5·9	540	5·1	610	4·3	670
K.A. 6	7·8	520	6·7	560	5·6	620
K.A. 7	12·5	480	10·3	545	8·0	635
K.A. 8	20·3	505	16·1	565	13·4	625
K.A. 9	24·0	450	20·6	485	17·0	525
K.A. 10	34·3	495	28·6	530	23·2	585
K.A. 11	56·0	460	45·0	520	36·0	565

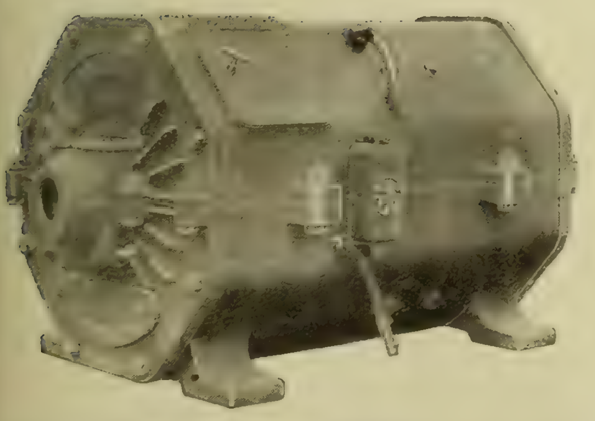


Fig. 1.—British Thomson-Houston Company's "K.A." Type Crane Motor.

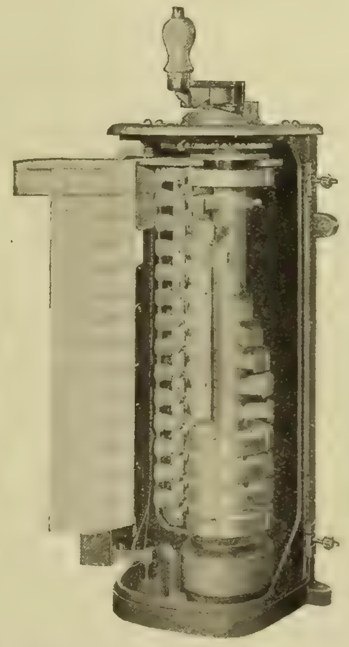


Fig. 2.—Typical Stoking Machine Controller by the B.T.H. Company,

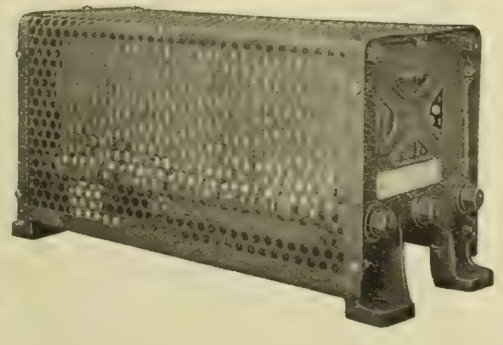


Fig. 3.—Typical Stoking Machine Resistance Unit by the British Thomson-Houston Company.

A "K.A." type motor, with its controller and resistance is shown in figs. 1, 2, and 3. The motor is designed for crane and hoist work, and is of robust construction and neat appearance. The traverse dimensions of the machine have been kept as small as is consistent with good design, in order to facilitate the arrangement of gearing, &c. In the smaller sizes, the motor carcase is one casting; but in the larger machines this frame is split on the horizontal axis, as shown in fig. 4. In all sizes the end shields are ribbed, both internally and externally, in order to provide large radiating surfaces, and are so fitted to the frame as to permit of their being turned through angles of 45°, 90°, or 180°; thus allowing the motor to be fixed on the floor, ceiling, wall, or sloping bulkhead. The bearings, the length of which is two-and-a-half times their diameter, are of low-friction bearing metal, and are lubricated by loose rings running on the shaft and dipping into large oil wells.

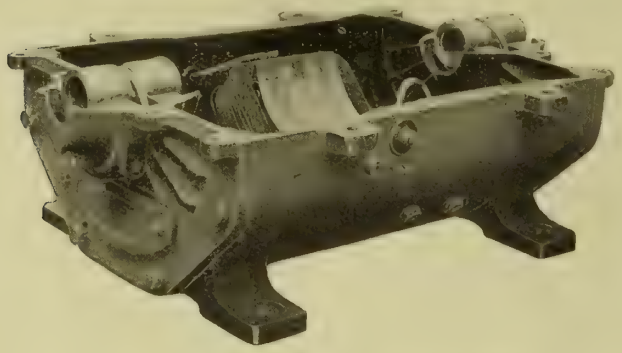


Fig. 4.—Lower Half "K.A." Type Crane Motor.

The armature is shown in fig. 5, and the brush holder in fig. 6, from which it will be seen that, following the standard tramway practice, the armature is so wound as to permit of commutation being effected by one pair of brushes situated in the most accessible position in the motor—that is to say, under the top inspection lids.

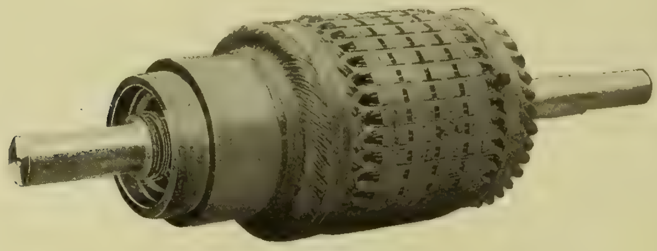


Fig. 5.—Armature of "K.A." Type Crane Motor.

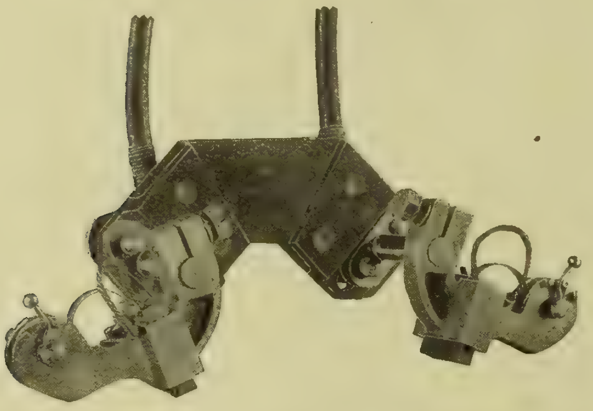


Fig. 6.—Brush Holder and Brushes, "K.A." Type Crane Motor.

COUPLING.

Where the power is transmitted from the armature shaft by means of spur or chain gearing, a comparatively large degree of misalignment would have to take place before the efficiency of the drive would be seriously impaired or the elements of the transmission damaged. But where the armature shaft is coupled direct to a worm or other gear box by means of the usual solid cast-iron coupling, the slightest degree of misalignment or distortion will result in a bending strain on both shafts, and will ultimately lead to either broken shafts or serious damage to their ends at the seatings of the respective couplings.

In the absence of a cast-iron combination bed-plate, there is a strong case for the employment of a flexible coupling, of which there are many excellent types on the market. The use of certain of these would greatly facilitate the work of changing the motor; the task of engaging their respective elements being much easier than the lining-up of the faces of a solid coupling, particularly if the member of the machine frame on which the motor and gear box are fitted happens to have been sprung. The use of a flexible coupling in such a case would enable the power to be transmitted between the motor and gear box without any destructive effect or loss of efficiency, even though a considerable degree of misalignment existed.

GEARING.

On a two, three, or four motor machine most of the gearing employed, extraneous to the actual motions, will be that which is necessary to bring the speed of the armature down to the figure at which it can be applied to the motion to which the motor is coupled; and this is usually performed in one stage by means of a worm and wheel enclosed in a cast-iron casing. It is the usual practice to use phosphor bronze worm wheels and hardened steel worms; while the end thrust, due to the worm, is taken by thrust bearings of ball or multiple plate type—the latter, in the author's opinion, being the best. These end-thrust bearings fulfil a most important function; and worm boxes should be watched closely for any signs of end-play in the worm shaft.

If, due to breakage or wear, the thrust bearings fail to fulfil their purpose, the duty of taking the thrust will fall upon the bearings of the motor to which the worm is coupled, with the result that, every time the worm takes up its drive, the armature shaft will be moved rapidly along its longitudinal axis until the end-play collars come into violent contact with the bearing bushes. These bushes cannot stand such collisions for long, and will soon be shifted in the end-bearing shields, in which, normally, they will be secured by keep studs or screws. When this has happened there is nothing to prevent the armature brushes coming into collision with the increased diameter of the armature behind its commutator.

In this connection, the writer might say that the worst breakdown in his experience was caused by the failure of a worm box end thrust bearing in this manner. In the plant under his charge the possibility of a recurrence of this trouble is guarded against by the provision of a gun-metal collar between the inner end of the half coupling on the armature shaft and the end bearing shield, as shown in fig. 7. With this arrangement a little end play—say, $\frac{3}{16}$-inch—is allowed; but should the thrust plates in the worm box fail, the blow given in the manner described upon the worm taking up its drive will be delivered to the entire motor, which, with its heavy carcase, will not come to any harm in the short time between the failure of the plates and the hammering action, which will call the operator's attention to the fact that there is something very wrong.

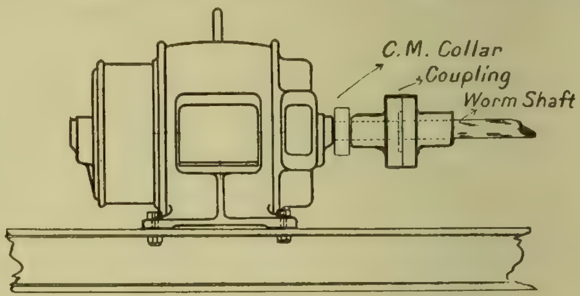


Fig. 7.

In connection with the raising-lowering motion, a worm box is to be favoured, on account of the self-locking characteristics which may be obtained by the use of a suitably-designed worm. It is admitted that a worm can only be designed for the purpose of holding its load by a sacrifice in efficiency; but the service of this motion is of a very intermittent character indeed, so that this diminution in mechanical efficiency is of very little importance, while the safeguard which the practice affords cannot, in reality, be overestimated.

Forged and cast steel spur gearing is used for some reductions on certain machines; and the efficiency and life of such drives can be greatly increased by the provision of cast-iron or sheet-steel gear-boxes, forming heavy oil-baths in which the whole of the gearing runs.

For high speeds, and for services where the teeth of the gears must withstand heavy and frequent shocks, raw hide or compressed paper pinions are applicable. For some time the writer has used a pinion of this type on a travelling motor; and while the wear on this pinion is greater than would be the case with a cast-steel pinion, the large and expensive spur wheel with which it gears shows no sign of wear after being in continuous operation for 2½ years. In this pinion the weaker material is reinforced by bronze end-plates riveted through the pinion. There would seem to be a field for such pinions for this class of work; it being well known that the decrease of strength with increasing velocity in an all metal gear train is due to the effect of impact.

WIRING.

It is essential, if freedom from electrical troubles is aimed at, that the wiring between the various electrical appliances should be carried out with the same degree of care as is expended upon the purely mechanical elements of the machine. With both stoking machines and telpher installations indifferent work in this respect—very often entrusted to the same fitter who puts up the machine—results in making an otherwise good machine a "bag of trouble" till a man who knows his work comes along and puts things right only after everyone connected with the plant has received a bad impression of the new machine. In the earlier machines, these arrangements were too often relegated to a back seat; and good machines, good motors, and controlling apparatus were ruined by the iniquitous manner in which the wiring was carried out.

The whole of the wiring should be carried in heavy gauge screwed steel conduit, and securely fixed to the various members of the machine frame. The manufacture of conduits and fittings for this purpose has reached a high degree of perfection, and suitable fittings can be easily and cheaply obtained, and the most awkward corners and circuit lay-out negotiated without exposing the cables at any point. These remarks apply with equal force to the small lighting circuits, which should be protected by good ironclad fuse-boxes fitted as close as possible to the source of electrical supply, and provided with removable fuse carriers.

STANDARDIZATION.

The load factor in respect to the motor used for operating the lowering-raising gear is much less than the corresponding factors of the discharging, charging, and travelling motors; and this motor is rated accordingly, just as the slewing motor of a crane is often rated on a quarter-hour duty basis. In regard, however, to the travelling and stoking motors, the difference in their respective load factors is not sufficiently great in some stoking machines as to warrant these motors being rated on a different basis, and in some cases these machines, with their controllers and their resistances, are interchangeable, both mechanically and electrically. This practice may sometimes lead to the provision of a larger travelling motor than is absolutely necessary. It must be remembered, however, that these motors come in for a lot of rough usage; and liberality of rating in this respect is a good point (unless, of course, it is carried to extremes), as the maximum power which a motor, however liberally rated, can exert may be limited by the setting of the circuit-breaker. Another advantage of standardization in this connection is that it enables the stock of necessary controller and motor spares to be much less than would be required if the two motors were of a different type. Any design that tends in the direction of standardization should find favour, always provided that efficiency is not sacrificed nor initial cost appreciably increased in the effort to obtain a high degree of standardization and interchangeability.

(*To be concluded.*)

DETERMINATION OF TOLUENE

WITH A NOTE ON THE APPLICATION OF THE METHOD TO BENZENE AND XYLENE.

By HUGH W. JAMES, A.R.C.Sc. (Lond.).

[A Communication to the "Journal of the Society of Chemical Industry," Feb. 29.]

The following method of determining toluene was devised in view of the extended nature of the Government requirement for coal-tar distillates. It is hoped that the method may prove useful to those manufacturers and chemists whose work may necessitate the use of a rapid and accurate test.

The results given in Part II. have been found of considerable assistance in following the progressive changes in composition of the distillates obtained from benzol stills that are employed in the production of pure benzene and pure toluene.

DETERMINATION IN NAPHTHAS.

The specification is divided into two parts. The object of Part I. is, by means of a fractional distillation, to obtain two fractions (I. and II.), of which the former is substantially a mixture of toluene and benzene, and the latter a mixture of toluene and xylenes. In Part II. each of these fractions is submitted to a rapid distillation, from the results of which the percentage of toluene in each case can be determined by reference to the tables provided.

A sample of one pint of the naphtha should be available. The top of the thermometer bulb should be ½-inch below the side tube of the flask or column. The thermometers used must be correct, or their error known. Barometric correction should be made on the basis of 0·1° for each 0·1 inch above or below the standard. A round-bottom flask should be employed, as the fractions can then be distilled to a small residue.

Part I.

In which the naphtha is submitted to a series of three distillations, referred to as stages A, B, and C. A fractionating column is necessary for all these distillations; one or other of the following being recommended: Le Bel-Henninger, 6 bulbs; Young's "rod and disc," 20 discs; Young's "pear" still-head, 12 bulbs; Young and Thomas's "evaporator" still-head.

Each stage—whether A, B, or C—should be started with a clean and dry flask, column, and condenser. The rate of distillation is to be maintained throughout at one drop per second from the end of the condenser. If the column is of such type that it retains liquid when in an upright position, it should be drained (by inverting or otherwise) into receiver No. 6 at the end of stages B and C.

PROCEDURE.

A. Distil 250 c.c. to 140° C. A preliminary distillation of 100 c.c. may be made. If at least 95 per cent. distils below 140° C., distillation A is dispensed with, and the original 250 c.c. is at once submitted to B.

B. Redistil the distillate obtained in A (or the original sample), collecting fractions in receivers numbered as under: 1. Below 90° C. 2. 90° to 100°. 3. 100° to 109°. 4. 109° to 112°. 5. 112° to 120°. 6. Residue at 120° C.

C. Redistil the fractions 2, 3, 4, and 5 separately, receiving all the liquid that distils below 110·6° C. in each case in receiver No. 1, and adding all residues that remain undistilled in each case at 110·6° to that in receiver No. 6.

If on redistilling No. 2 the residue in the flask becomes so small that distillation must be stopped before 110·6° C. is reached, the flask is allowed to cool. Fraction No. 3 is then added to the residue of No. 2, and the distillation continued. If the distillation of No. 3 or of No. 4 has similarly to be stopped before 110·6°, the same procedure is to be followed; No. 4 being added to the residue of No. 3, and No. 5 to the residue of No. 4.

EXCEPTIONS.

No. 1.—Crude Unwashed Naphtha.

If a crude unwashed naphtha is under examination, it must be distilled to 150° in stage A. The distillate is washed with sulphuric acid in the usual way, and is then submitted to B; the following fractions being collected: 1. Below 90°. 2. 90° to 100°. 3. 100° to 109°. 4. 109° to 112°. 5. 112° to 120°. 6. 120° to 140° C. In stage C, all the above fractions are separately distilled to 110·6° into No. 1; and all the residues at that temperature are poured, when cold, into a vessel No. 7.

No. 2.—Commercial Benzol or Toluol.

If a commercial benzol or toluol is under examination, it is at once submitted to B, as in this case stage A is not required.

Part II.

The sample now having been separated into three fractions—namely: No. I. Distillate obtained below 110·6°, in vessel No. 1; No. II. Distillate from 110·6° to 140°, in vessel No. 6 (or 7); No. III. Residue at 140°, which, if any, is discarded, proceed as follows:

Nos. I. and II. are measured, and the volumes corrected for loss due to the film of liquid remaining in the several receivers used in each case. The amount of this loss must be determined. This may be done by pouring a known volume of benzol or toluol from a graduated measure into each receiver; agitating it in order completely to moisten the interior of the vessel; and subsequently draining the liquid back into the measure, noting the loss in volume.

PRECAUTIONS RELATIVE TO PART II.

Before distilling, the flask and condenser tube should be moistened with the fraction to be distilled in each case, and allowed to drain. After distillation, and when cool, the residue is drained into the measure containing the distillate, and any loss added to the observed volume of distillate. The graduated vessel used in measuring out the liquid should be employed, without drying, for collection of the distillate.

The flask used should have a neck about 5 inches long, with side tube at about the middle of the neck; and the bulb should be of about 150 to 180 c.c. capacity.

PROCEDURE.

No. I. Fraction.—This fraction (or 100 c.c., if there be sufficient of it) is distilled from a distillation flask, with side tube in the neck, at the rate of two drops per second. The distillation is stopped at 85°, 90°, 95°, 100°, and 108° C.; the total percentage of distillate, if any, at each temperature being noted. It will be found that one of the readings will be within, or very near, the range of one of the columns in Table I., from which the percentage of toluene in Fraction I. can be interpolated.

The distillation is finished when the total percentage of distillate at one of the above temperatures falls within the range of the corresponding column in Table I.

No. II. Fraction.—This is similarly treated; the distillation being stopped at 115°, 120°, 125°, 130°, and 137° C., and the total percentage of distillate again noted for each temperature. Reference is then made to Table II.

From the resulting figures the total toluene in each Fraction I. and II. is calculated, and the sum of these is the toluene in the original 250 c.c. of naphtha.

The following particulars of a commercial benzol illustrate the procedure: *Fraction I.* 234 c.c. giving 83 per cent. distillate at 85° C. Reference to Table I., column 1, indicates that it contains approximately 9 per cent. toluene = 21·1 c.c. *Fraction II.* 15 c.c. giving distillates as under: 115°, 27 per cent.; 120°, 57 per cent.; 125°, 65 per cent.; 130°, 78 per cent. Reference to Table II., column 2, shows that a distillate of 57 per cent. at 120° represents approximately 69 per cent. toluene = 10·3 c.c.; total toluene, 31·4 c.c.; toluene in original sample $\frac{31·4}{250} \times 100 = 12·6$ per cent.

The method is available for determination of toluene in crude coal-tar naphtha; in the light oils resulting from the scrubbing of coal gas and of coke-oven gas; in commercial benzol, toluol, and solvent naphtha; also for the determination of toluene in "motor benzol" to which solvent naphtha has already been added. The time required for carrying out a test averages about 3½ hours.

TRIAL OF VARIOUS MIXTURES OF BENZENE, TOLUENE, AND XYLENES.

The percentage of toluene indicated by the preceding test is placed against the known percentage of toluene in each case in the table [p. 532].

Considerable experience and practice with the above method have shown that, for naphthas containing not less than 30 per cent. of toluene, the amount of error should not reach 1 per cent. In the case of naphthas containing less than 30 per cent., the error may reach, or slightly exceed, 1 per cent. The indications are

No.	Benzene.	Toluene.	Xylenes.	Heavy Naphtha and Creosote.	Toluene Indicated by Test.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1	86	12	2	—	12 6
2	20	65	15	—	65·2
3	3	15	82	—	16 0
4	47	3	50	—	5·2
5	5	90	5	—	89 6
6	18	8	18	56	7·0
7	50	0	50	—	3·0

unsatisfactory only when toluene is absent, or present in small quantity. A more rigorous fractionation in the first part of the test would reduce this error; but it would be unwise to make the method more complicated and more lengthy in order to deal with such cases.

A course of procedure for naphthas of low toluene content would be to carry out the determination on a mixture consisting of 40 per cent. of pure toluene and 60 per cent. of the naphtha under examination. The results, after allowing for the added toluene, will then be satisfactory.

CORRECTION FOR PARAFFINOID HYDROCARBONS.

Paraffinoid hydrocarbons are detected by a specific gravity determination, which should be made on Fraction II. at 15·5° C. The specific gravity of this fraction should lie between ·865 and ·870, as the toluene obtainable from such a naphtha would include, at most, only traces of paraffins, and would have a specific gravity above ·868, and thus be of a quality suitable for those purposes for which pure toluene is required.

In the actual determination of the paraffins, it may be taken that the "pure" toluene obtainable from a naphtha would contain 1 per cent. of paraffinoid hydrocarbons for every ·002 by which the specific gravity of Fraction No. II. at 15·5° C. falls short of ·867.

For example, a naphtha shows, on analysis, 74·0 per cent. of toluene. The specific gravity of Fraction No. II. is ·861—that is, ·006 below ·867. The "pure" toluene from this naphtha would contain 3 per cent. of paraffins. To correct the indicated per cent. of toluene for this, subtract from it 3 per cent. of its total, thus: 74 × 0·03 = 2·2 (approximately). Toluene in the sample = 74·0—2·2 = 71·8 per cent.

DETERMINATION IN COAL TAR.

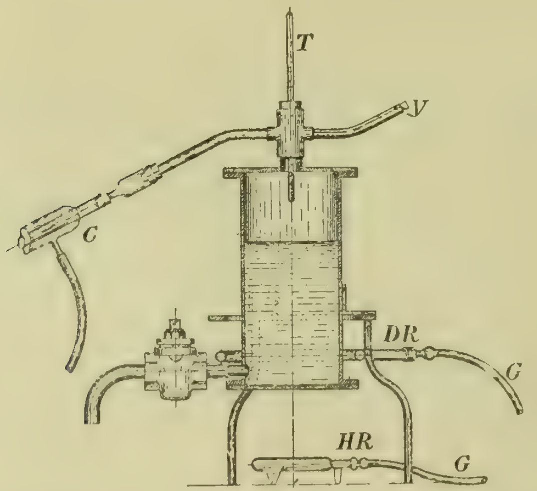
For the purpose of determining the toluene in coal tar it is necessary to separate the crude naphtha from the tar by fractional distillation, and to wash this naphtha (which contains the whole of the toluene) with sulphuric acid before applying the test described above.

Sufficient of the tar is distilled to yield at least 250 c.c. of crude naphtha. Generally, 8000 c.c. of tar will be found ample. Some tars, however, contain so much naphtha that 4000 c.c., or even less, may be based.

Part I.

DISTILLATION OF THE TAR.

The tar is placed in a glass retort or an iron still—preferably the latter. A convenient and easily constructed still is shown in the diagram.



T. Thermometer. V. Cork loosely inserted to act as a safety valve. C. Water-cooled condenser. GG. Gas supplies. HR. Ring-burner for preliminary heating. DR. Ring-burner employed as additional source of heat when water has been distilled off.

Tar Still for Laboratory Use.

A thermometer is fitted in such a position that the bulb is surrounded by the vapour in the still. The delivery-pipe of the still is connected to a water-cooled condenser. Distillation is then started. The distillate is collected in a receiver which, when the

Toluene Per Cent.	TABLE I.					TABLE II.				
	Mixtures of Toluene and Benzene.					Mixtures of Toluene and Xylenes.				
	85	90	95	100	108	115	120	125	130	137°
3	98·2									4·0
4	94·5									6·5
5	91·0									11·0
6	89·2									17·0
7	87·0									23·0
8	85·0									28 0
9	82·6									32·3
10	80·0									37·0
11	77·0									41·0
12	74·2									45·0
13	71 0									48·5
14	68·0									51·2
15	64·0									53·5
16	60·0									55·8
17	56·2									58·0
18	52·4									59 8
19	48·0									61·5
20	42·5									63·3
21	37·0									65·0
22	32·0									66·4
23	28·0									67·8
24	23 0									69·2
25	17·0	71·3							21·7	70·5
26		69·5							24·7	
27		67·2							27·5	
28		65·0							30 3	
29		63·0							33·0	
30		60·7							35·7	
31		58·0							38·2	
32		55·6							40·7	
33		53·0							43·1	
34		50·5							45·4	
35		48·0							47·6	
36		45·0							49 8	
37		42·1							51·8	
38		39·5							53·5	
39		35·5							55·3	
40		33·2							57·2	
41		30·0							59·0	
42		26·8							60·7	
43		23·2							62 3	
44		19·5							63·8	
45		16·0	57·0					36·3	65·3	
46			55·3					38·8		
47			53·5					41·2		
48			51·5					43·4		
49			49·5					45·7		
50			47·2					48·0		
51			44·9					50·2		
52			43·0					52·3		
53			40·2					54·5		
54			38·0					56·6		
55			35·2				17·0	58·6		
56			32·8				20·0			
57			30·5				23·5			
58			28·0				26·5			
59			25·0				29·5			
60			22·0	56·5			32·7			
61				54·5			35·7			
62				52·3			38·7			
63				50·1			41·5			
64				47 9			44·0			
65				45·6			46·7			
66				43·2			49·5			
67				40·8			52·1			
68				38·2			54·9			
69				35·7			57·2			
70				33 0			59·6			
71				30·0			62·0			
72				27·0			64·5			
73				24·0			67·0			
74				21·0			69·4			
75				18·0	76·0		71·6			
76					75·0		73·7			
77					73·9		75·7			
78					72·6		77·5			
79					71·3		79·2			
80					70·0	41·5	80·9			
81					68·4	46·0				
82					66·8	50·0				
83					65·0	54·0				
84					63·0	58·0				
85					60·8	62·0				
86					58·2	66·0				
87					55·9	70·0				
88					52·5	73·5				
89					49 1	76·3				
90					45·0	79·3				
91					40·0	82·2				
92					35·0	85·0				
93					29·0	87·7				
94					21·0	90·4				
95					11·0	93·0				
96					6·0	95·5				
97					3·0	98 0				

thermometer indicates 220° C., is removed and a second receiver substituted for it. When this change of receivers is made, the supply of water to the condenser is shut off. The distillate is collected in the second receiver until the thermometer indicates 260° C., at which point the distillation is stopped.

During the time that the distillate is being collected in the first receiver, a sample, amounting to two or three drops of the distillate, should be taken periodically, and allowed to fall upon the surface of cold water contained in a beaker or other suitable vessel. When one of these samples becomes partly or wholly solid, the water supply to the condenser is shut off, and the water remaining in the condenser is allowed to become warm. The water supply is shut off in any case, as stated above, when the change of receivers is effected. This is done so as to avoid the risk of blockage by naphthalene, which would be dangerous.

From the foregoing procedure two fractions are obtained: (*a*) Light oil and water up to 220° C.; (*b*) creosote oil, 220° to 260° C.

Part II.

DISTILLATION OF THE PRODUCTS OBTAINED IN PART I.

For this purpose a fractionating column is employed. A strip of cotton material is wound round the column in such a manner as completely to cover it except the side tube and the portion that projects within the neck of the flask containing the product to be distilled. This prevents the formation of too much liquid by undue condensation in the column. The top of the thermometer bulb should be ½-inch below the side tube of the column.

The light oil is separated from the water and is then distilled to 190° C. The water is measured. The creosote oil is similarly distilled to 190°. The distillate from the creosote oil is now added to that obtained from the light oil, and the mixture is thoroughly shaken. If any water settles out, it is separated and measured. The total quantity of water obtained from the tar is noted.

The mixture of distillates obtained from the light oil and the creosote oil now constitutes the crude naphtha of the tar. The crude naphtha is measured; and 250 c.c. is distilled to 150° C., and treated as described in "The Determination in Naphthas." [*Vide* "Exception No. 1" *ante.*]

The following are particulars of an actual determination: Tar taken, 7000 c.c.; less water, 300 c.c.; tar (anhydrous), 6700 c.c. Yield of crude naphtha, 400 c.c.

DETERMINATION OF TOLUENE IN THE CRUDE NAPHTHA.

Distillate to 150° (prior to washing with acid), 106 c.c.; loss on washing with acid, 8 c.c.; washed distillate = 98 c.c.

Fraction I.—49 c.c., giving 35 per cent. distillate at 85° C. Reference to Table 1, column 1, indicates that it contains 21·4 per cent. toluene = 10·5 per cent.

Fraction II.—29 c.c., giving 43 per cent. distillate at 120° C. Reference to Table II., column 2, indicates that it contains 63·6 per cent. toluene = 18·4 c.c. Toluene in 250 c.c. of naphtha, 28·9 c.c. The total amount of toluene in the 400 c.c. of naphtha, and, of course, in the tar from which this naphtha was distilled, is $\frac{28·9 \times 400}{250} = 46·2$ c.c. The amount of toluene in the anhydrous tar is, therefore, $\frac{46·2 \times 100}{6700} = 0·69$ per cent.

Assuming that 1 ton of coal yields 10 gallons of anhydrous tar, and taking the weight of 1 gallon of toluene as 8·7 lbs., the amount of toluene obtained per ton of coal carbonized will be 0·069 × 8·7 = 0·60 lb.

DETERMINATION OF BENZENE.

No. I Fraction, Part II., contains the benzene present in the original naphtha; and, consequently, its amount can be approximately ascertained by subtraction from the total volume of this fraction of the amount of toluene it contains. As determined in this manner, the figure found will include any carbon bisulphide and thiophen present.

DETERMINATION OF XYLOL (SOLVENT NAPHTHA).

The determination of the xylenes by fractional distillation is not satisfactory, owing to the probable presence of ethylbenzene and other hydrocarbons. For the approximate estimation of xylol (solvent naphtha) the following procedure, in the case of a crude naphtha, will demonstrate the method. Distil the naphtha to 190° C. (through a column), wash the distillate with sulphuric acid, &c., and submit the washed naphtha to stage A of the toluene determination (*vide* "Exception No. 1—Crude Naphtha"), collecting, however, an additional fraction distilling between 150° and 170° C. The amount of xylol will then be found by adding together the following three quantities: (*a*) The fraction obtained in stage A between 150° and 170°; (*b*) the fraction obtained in stage B between 140° and 150°; (*c*) the difference between the quantity of toluene in Fraction II. and the total of that fraction.

APPLICATION TO WORKS PRACTICE.

In the case of benzol stills employed in the production of pure benzene and pure toluene, the distillate obtained between the two pure products, though it may contain very small amounts of xylenes, &c., may be regarded practically as a mixture of toluene and benzene; also, the distillate that follows after pure toluene has ceased to appear may be regarded practically as a mixture of toluene and xylenes. Consequently, by submitting 100 c.c. of the run of the still to distillation as described in Part II. of the method for the determination in naphthas, and by subsequent reference to the tables given, the composition of the distillate at any moment can be revealed, and thus the course of the distillation can be intelligently followed.

This simple test can be performed by the stillman himself with very little practice, and it can be accomplished in a few minutes. It is hardly necessary to lay stress on the advantage of knowing exactly what a still is doing at any moment.

NOTE ON THE WASHING OF NAPHTHA WITH SULPHURIC ACID.

The naphtha is shaken with 10 per cent. of its volume of concentrated sulphuric acid for ten minutes in a separating funnel. [The mixture of acid and naphtha frequently becomes so hot that partial sulphonation of the latter occurs. To obviate this as far as possible, the separator containing the mixture should be immediately immersed in cold water, and shaken under the surface of the water until the contents no longer tend to become hot.] The separator is allowed to stand for half-an-hour for settlement of the brown "acid tar." This is then run off and 50 c.c. of water is poured in, but not agitated with the naphtha. When complete separation has occurred, the water is drawn off, and similar washings of water are poured in, without shaking, until they are free from opalescence. The naphtha is then, and then only, shaken gently with further successive washings of water until these no longer show opalescence. Then 10 c.c. of a clear solution of caustic soda (sp. gr. 1·075) is run in and shaken with the naphtha, and drawn off, after complete separation. [If the solution of caustic soda is not entirely free from suspended solid matter, difficulty will probably be experienced in effecting a separation from the naphtha.] Finally, the naphtha is shaken with two washings of water, each of 50 c.c., which are drawn off to the last drop.

London and Southern District Junior Gas Association.—Next Saturday members will visit the Lower Sydenham works of the South Suburban Gas Company; and on Friday, the 24th inst., there will be a meeting at the Westminster Technical Institute, at which Mr. E. W. L. Nicol, the Engineer and Fuel Expert to the London Coke Committee, will deliver an address on "Coke Fuel for Steam-Boilers."

Tar Oils for Diesel Engines.—In an article on Diesel engines in the "Times Engineering Supplement," the writer refers to the researches of Mr. Charles Day, who, he says, in a recent contribution to the proceedings of the Diesel Engine Users' Association, indicated that tar-oils suitable for use in engines of this type were obtainable not only from gas-works, but from coke-ovens, blast-furnaces, and certain gas-producers. As to gas-works, tar resulting from distillation in horizontal retorts did not prove altogether desirable, owing to the percentage of free carbon; but vertical retorts were found to yield a tar in every way serviceable.

Southern District Association of Gas Engineers.—At the annual meeting, on Thursday of next week, at the Hotel Cecil, the new President (Mr. W. Doig Gibb) will deliver his Inaugural Address; and thereafter two papers which were prepared for the November meeting (but held over through lack of time to consider them) will be read and discussed. One of these is on the "Construction of Concrete Purifiers at Romford in 1913," by Mr. W. D. Child; and the other is a "Short Description of the Carbonizing Plant at Southampton, and Results Compared with Previous Years," by Mr. F. Durkin. The chair will be taken at 2.30; and after the meeting tea will be served—the annual dinner having been abandoned, owing to the war.

Centenary of the Exeter Gas Company.—The Exeter Gaslight and Coke Company (a report of whose annual meeting appears in another column) will celebrate its centenary next month, having been incorporated in April, 1816. An article dealing with the early history of gas supply in Devonshire appeared in the "JOURNAL" for April 20 last year [p. 161]; so that now it need merely be mentioned that, as early as April 10, 1815, it is recorded that the shop of Alderman Philip, in Fore Street, was lit with gas. By October 1816, pipes had been laid down through the central thoroughfare of the city as far as Paris Street, and by July, 1817, it was announced that the whole of the Fore Street had been lighted with gas for several nights. In 1841 the gas made was 13 million cubic feet, and sold at 9s. 6d. per 1000 cubic feet; in 1865, 84 millions, at 4s. 2d.; 1878, 161 millions, at 4s. 2d.; and in 1915, 452 millions, at 2s. 10d.

Trading with Enemies.—A Royal Proclamation dated Feb. 29, called the Trading with the Enemy (Neutral Countries) Proclamation, 1916, sets forth that: "All persons or bodies of persons, incorporated or unincorporated, resident, carrying on business, or being in the United Kingdom, are hereby prohibited from trading with any of the persons or bodies of persons mentioned in the list hereunder written, which list, with such variations therein or additions thereto as may be made by any Order made by the Lords of the Council on the recommendation of a Secretary of State under the power in that behalf given by section 1, subsection (2) of the Trading with the Enemy (Extension of Powers) Act, 1915, shall be called the 'Statutory List.'" Among the large number of names included in this Statutory List are to be found: Brasch and Rothenstein, 320, Amsterdam, and Boompjas 40A, Rotterdam; the "Metropol" Gasgloeilichtfabriek (Gloeikousjesfabrik), Parkstraat 15, Arnhem; "Monopol" Gasgloeilichtfabriek, 487 Prinsengracht, Amsterdam; J. Norden, Stationsweg 43, Rotterdam; and the Gaswerk, Santa Cruz, Tenerife.

EFFECT ON THE SIDES OF A GASHOLDER BELL OF A ONE-SIDED LOAD ON THE CROWN.

The following is a summary of the contents of a communication on this subject to the "Journal für Gasbeleuchtung" of Oct. 16 last by Herr Schmidt, an Engineer attached to a firm of gasholder builders at Dortmund.

If the diagonal stiffening inside the bell walls is wanting, any panel bounded by two adjacent vertical posts can become distorted to such an extent that the side sheets lose their curvature in the direction of one diagonal, and a double fold is formed in the direction of the other diagonal. The distortion or obliquity of the whole side walls which is thereby produced can be determined mathematically, as the author proceeds to show by reference to figs. 1, 2, and 3. The section through the side of the holder along the diagonal $a\ b_1$ is an arc of an ellipse of which the depth or pitch f equals the chord $a\ b = s$ of the circle of radius r, and A is half of the major axis, and ρ the radius of curvature on the arc $a\ b_1$ of this ellipse. Then the expression for the right angle x (fig. 3) is found to be:

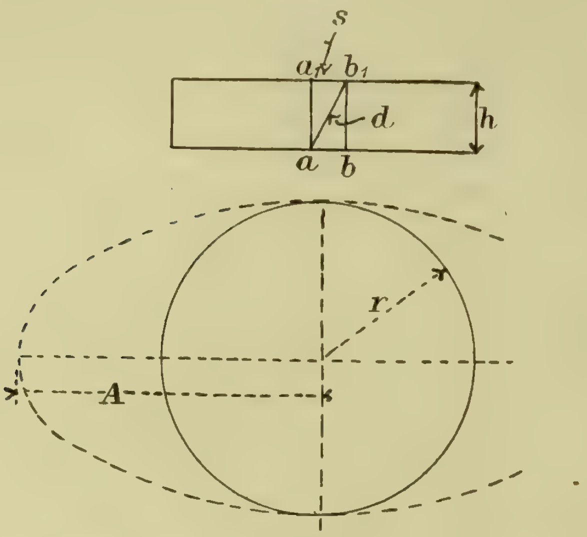


Fig. 1.

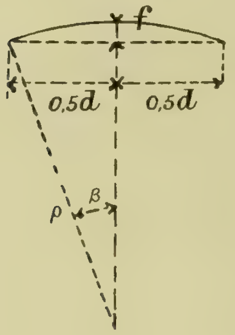


Fig. 2.

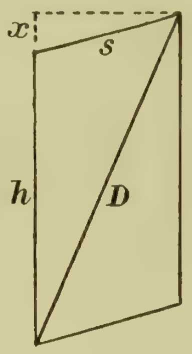


Fig. 3.

$$(1)\qquad x = \frac{2\pi^4\ r^2}{3n^4h}$$

in which n is the number of vertical props in the whole circuit of the bell. Then the total distortion or obliquity (S) of the walls of the bell, being equal to 0·5 $n\ x$, we have:

$$(2)\qquad S = \frac{\pi^4}{3n^3}\left(\frac{r^2}{h}\right).$$

When the holder is telescopic, the average diameter of all the lifts must be taken for the value of r in this equation.

With such a distortion of the whole bell, there will be an overbalancing, or overweighting, of the water in the cups. With measurements expressed in metres, the moment (M_t) in tonne-metres of this overweighting for the horizontal central axis of the bell will be [*vide* fig. 4] for one cup only:

$$(3)\qquad M_t = \frac{4}{3}\left(\frac{\pi}{n}\right)\frac{br^4}{h}.$$

And for a number (m) of cups:

$$(4)\qquad mM = m\ \frac{4}{3}\left(\frac{\pi}{n}\right)^3\frac{br^4}{h}.$$

Snow gives the most unfavourable one-sided loading of the crown, as it may cause turning in the same direction as the wind acting on the sides. Wind pressure on the crown may be ignored [see fig. 5]. The moment, M_s, of the one-sided snow-pressure is, according to the formula given in the German standard rules for gasholder construction, in tonne-metres: 0·001 × $r^2\ \pi$ × 20 × 0·424 r = 0·00848 $\pi\ r^3$. The ratio of M_t to it is therefore:

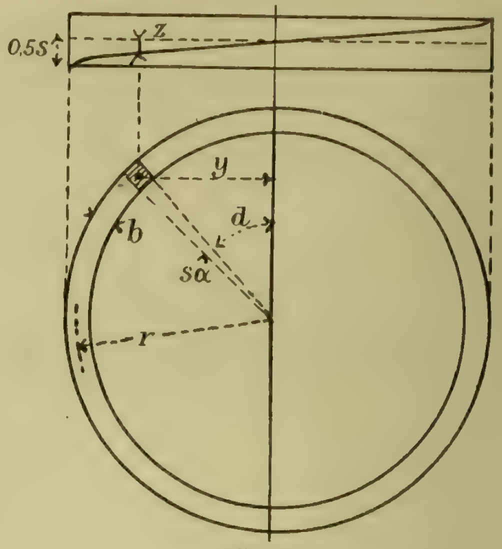


Fig. 4.

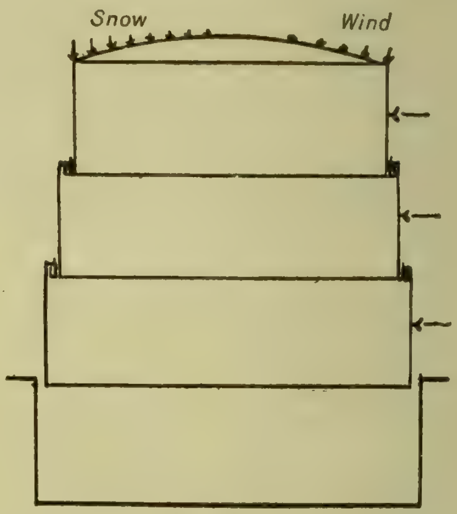


Fig. 5.

$$(5)\qquad \frac{mM_t}{M_s} = \frac{1551\ mbr}{n^3h}.$$

Examples show that the distortion or obliquity S is comparatively small with large gasholders; and there is therefore no danger in omitting diagonal stiffening from the upper lift of such holders, especially when the vertical props are riveted to the side sheets. When this riveting is omitted, any diagonal stiffening would only serve to increase the lateral resistance to breaking strain of the vertical props. As even the thin side sheets, in conjunction with the vertical props, give an effective diagonal tieing of the sides of the bell, the result is great resistance of the latter to a one-sided load on the crown. Hence with a telescopic holder raised to its highest position, it may be assumed that only the highest and lowest rings of the bell afford resistance to this load by horizontal forces H [fig. 6] which can readily be determined.

This determination of S also serves for calculating the margin of safety of the seal of a cup of a certain size. If the cup has the proportions shown in fig. 7, in which p signifies the maximum pressure thrown by the bell, S must not exceed a certain figure, if the cup—notwithstanding the obliquity—is to afford security against the water flowing over the rim a, or gas escaping under the dip-plate b. This figure is given by the equation $S + c = p$, in which c may be taken as about equal to 0·05 metre [nearly 2 inches]. The value of p, expressed in metres, is then:

$$(6)\qquad p = c + \frac{\pi^4\ r^2}{3n^3\ h}$$

There is risk of overflow when n is small, or when the capacity of the bell is low. With large holders there is little risk of this; but the strain on the material resulting from the distortion caused in the sides by one-sided pressure of snow must be determined. This will be seen from fig. 6 to be greatest when only the top lift of the bell is raised, as H then has its greatest value.

One example given by the author is: Taking r = 20 metres [65·6 feet]; h = 10 metres [32·8 feet]; b = 0·26 metre [10¼ inches]; p = 0·24 metre [9½ inches]; n = 32; and m = 3 metres [9·84 feet]. Then by equation (5), it is found that M = 213 tonne-metres, and $M_s + m\ M_t$ = 228·8 tonne-metres. With the topmost lift only in use, H = $\frac{M_s}{10}$ = 21·3 metric tons. The maximum horizontal force which can come on a panel between two adjacent verticals is 1·331 metric tons, and the greatest diagonal strain occurring in the side walls of the bell is 3·637 metric tons.

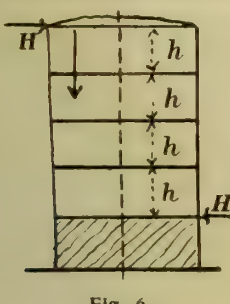


Fig. 6.

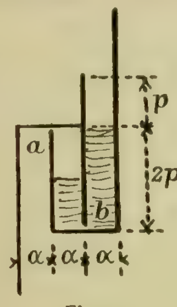


Fig. 7.

If the side sheets are 0·23 centimetre [0·09 inch] in thickness, and 0·9 metric ton is a safe strain, then a width of 17·5 centimetres [6·9 inches] will take up the diagonal strain. Conversely, the least safe height of the sides of the bell may be calculated by equation (6) to be 2·08 metres [6·82 feet]. But since h has been taken as equal to 10 metres, it follows that there is no risk of the water running over the cups. The moment of the cup water is 15·76 tonne-metres, and S is 39 mm. [1·54 inches]. The effective capacity of the holder is 51,000 cubic metres [1,800,000 cubic feet].

In a second example, the author takes $r = 10$ metres [32·8 feet]; $p = 0{\cdot}15$ metre [5·9 inches]; $b = 0{\cdot}2$ metre [7·9 inches], and $n = 16$. With $c = 0{\cdot}05$ metre [nearly 2 inches], the least safe height of the sides of the bell is found by equation (6) to be 7·9 metres [25·9 feet]. The capacity of this holder with two lifts is 175,000 cubic feet. The maximum permissible ratio $\frac{2r}{h}$ then becomes $= \frac{20}{7{\cdot}9} =$ about 2·5. The moment of a one-sided load of snow attains 26·63 tonne-metres; and as $n = 16$, with the top lift cupped, H is equal to $\frac{26{\cdot}63}{7{\cdot}9} = 3{\cdot}37$ metric tons, and $s = \frac{20\ \pi}{16} = 3{\cdot}93$ metres [12·9 feet]. Hence

$$d = \sqrt{7{\cdot}9^2 + 3{\cdot}93^2} = 8{\cdot}82\text{; and } \frac{d}{s} = 2{\cdot}24.$$

Then as the greatest diagonal tensional strain in the side sheets is $\frac{3{\cdot}37}{8} \times 2{\cdot}24 = 0{\cdot}943$ metric tons, the thickness of the sheets may be 0·2 centimetre [0·079 inch] and the width of a strip of the side sheeting which will take up this strain becomes $\frac{0{\cdot}943}{0{\cdot}2 \times 0{\cdot}9} =$ 5·2 centimetres [2·05 inches], which is considerably less than in the first example. S here is equal to $\frac{97{\cdot}4}{3 \times 16^3} \times \frac{100}{7{\cdot}9} = 0{\cdot}10$ metre [3·94 inches], and the moment of the cup water is found to be 2·55 tonne-metres and the ratio $\frac{M_t}{M} = \frac{2{\cdot}55}{26{\cdot}63} = 0{\cdot}095$. Since S in this case is comparatively large, it is desirable, with small gasholders, that the side walls should be stayed or stiffened internally—having regard to the considerable deformation which would otherwise occur—in order to ensure the sides remaining gas-tight.

Society of British Gas Industries.—We learn from the Secretary (Mr. Arthur L. Griffith) that the annual general meeting of the Society will be held at the Trocadero Restaurant, Piccadilly Circus, W., on Wednesday, the 29th inst., and the annual dinner will take place the same evening.

New Lighting Order for London.—A fresh lighting order, of still stricter provisions than its predecessors, will come into force in the Metropolitan Police District on Friday. Among other things, it states that in shops lights must be screened to prevent any escape of direct light, or lights reflected from mirrors, &c. In all private houses and premises not otherwise provided for, unless the lights are adequately shaded at their source, light coloured blinds or curtains are no longer permissible. The order will take effect during the remainder of March from 6.30 p.m. until sunrise; during April, from 7.30; during May, from 8 o'clock; during June, and until a further order is made, from 9 o'clock to sunrise.

Calorific Value Standard in Massachusetts.—The Massachusetts Gas and Electric Light Commission have, according to the "American Gaslight Journal," recommended a Bill to the Legislature which would empower the Board from time to time to determine how many British thermal units shall be required of gas supplied by companies and municipal plants to their customers—in no event to be less than 550 B.Th.U. Thereafter, if the company, town, or city shall be found on three consecutive inspections, or within thirty days, to be supplying gas below the established calorific standard (unless such defect is unavoidable) a fine of $100 may be imposed. The Bill provides that, in connection with inquiries made by the Board under the above provision, it may suspend the operation of the law as to a candle power of gas for periods not exceeding nine months. It also provides that every gas company or municipal plant distributing more than 15 million cubic feet a year shall, when required by the Board, provide and maintain a suitable room, not less than ½-mile from the gas-works, with a calorimeter of approved type, for the use of the State inspectors.

EFFECT OF ALTITUDE ON GAS-ENGINES.

The issue of "Gas Age" (New York) for the 15th ult., quotes from the "Journal of Electricity, Power, and Gas" some observations on this subject by Mr. J. E. Megson.

The author writes: Due to the reduced density—that is, the weight per cubic foot of the atmosphere at higher altitudes—the amount of oxygen drawn into an engine-cylinder is lessened; and therefore the quantity of fuel with which it will combine and burn is relatively decreased. Consequently a gas-engine will not develop as much power at a higher elevation as it will at lower altitudes. For altitudes less than 500 feet above sea-level, no reduction in horse-power or alteration of fuel consumption need be contemplated; but at higher elevations a reduction in horse-power is necessary in accordance with the accompanying table:

Table of Altitudes in Feet above Sea Level;

with Corresponding Approximate Barometric Readings, Atmospheric Pressures, and Proportionate Densities.

[The capacity of an internal combustion engine at higher altitudes, as compared with its capacity at sea-level, is practically proportional to the atmospheric densities.]

Altitude in Feet.	Barometer in Inches.	Atmospheric Pressure. Pounds per Square Inch.	Proportionate Atmospheric Density.
0·00	30·0	14·72	1·00
500·00	29·5	14·45	0·98
1,000·00	28·9	14·18	0·96
1,500·00	28·4	13·94	0·94
2,000·00	27·9	13·69	0·93
2,500·00	27·4	13·45	0·91
3,000·00	26·9	13·20	0·89
4,000·00	26·0	12·75	0·86
5,000·00	25·1	12·30	0·83
6,000·00	24·2	11·85	0·80
7,000·00	23·3	11·44	0·77
8,000·00	22·5	11·04	0·75
9,000·00	21·7	10·65	0·73
10,000·00	20·9	10·26	0·70

The table shows the height of the barometer in inches and the equivalent density of the atmosphere. The horse-power output of the engine will be proportionate to the equivalent density—that is, a 500 H.P. engine at sea-level, at 5000 feet elevation will be 500 × 0·83, or 415 H.P. The fuel consumption of this engine, however, must also be revised; an addition of 1 per cent. or fraction thereof being made for each 1000 feet elevation.

The capacity of the cylinder also definitely limits the output of an internal combustion cylinder at any altitude, as the combustion of the fuel depends entirely upon the amount of oxygen in the cylinder—a certain amount of oxygen giving complete combustion to a certain amount of fuel oil, which, in turn, develops a certain amount of power. Ordinarily internal combustion engines are rated at 10 per cent. below their ultimate capacity; and it is dangerous and uneconomical, the author points out, to operate the engines at a greater load than is specified by the manufacturers, although this may be possible for short intervals.

Employment and the Munitions of War Acts.

The very large amount of special legislation which has been brought about with such lightning-like rapidity, under the stress of an altogether unpreconceived state of affairs, has created doubts in the minds of many people as to exactly how they stand in one respect or another. With an exceptionally abundant crop of new rules, regulations, "musts," and "must-nots" to master, and far less opportunity than usual to master them, the layman has naturally been forced to turn to the expert for guidance; and the expert has not been found wanting. Several examples of the readiness of those who have studied this emergency legislation to share with others the knowledge gained by them have been quoted in our pages; and now attention has been called to a further instance, by the receipt of a book on "Employers and Workmen under the Munitions of War Acts, 1915 and 1916," compiled by Sheriff Fyfe, of Glasgow, and published at 2s. 6d. net by Messrs. William Hodge and Co., of No. 12, Bank Street, Edinburgh. The author's position as Chairman of the Glasgow Munitions Tribunal has afforded him ample facility for becoming familiar with the Acts and the questions most likely to arise under them; and he has utilized his experience in describing in plain language what the Acts really mean, and what penalties they impose. There is an appendix in which the provisions of the Amending Act are fitted into their places in the original Act—the amendments being printed in red. Two other appendices are also included; one containing the rules for arriving at the excess profits in controlled establishments, the other the rules as to dismissal of workmen, clearance certificates, &c. A good index is provided to the book; and glancing through it, one is forcibly struck by the number of references under the heading of "Penalties." With so many possibilities of pecuniary loss as are here revealed, it is evident that the half-crown required for purchase might very soon be saved by a perusal of Sheriff Fyfe's timely little book.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Dyes and High Explosives.

Sir,—A very remarkable speech on the above was made at the annual meeting of the Bradford Dyers' Association, Limited, by Mr. Milton S. Sharp, the Chairman of the Board of Directors. I have no doubt that this has not escaped your notice, and that you will not fail to extract from it the lessons needed by us all. I take great interest in this particular question. War found Great Britain unprepared. Is Peace going to find us still more unprepared?

Some of the facts which Mr. Sharp, with his great knowledge of the dye industry, brings before the public—or rather I should say before a small portion of the public—need grave consideration. He states that the dye industry is a "key" industry—a key to export business aggregating £200,000,000 a year, and to the employment of 2,000,000 people. I select a sentence from his speech which I recommend all to read. They will find it buried in "The Times" of Tuesday, Feb. 29, in the financial columns, although it is true that "The Times" directed special attention to the speech. Well, the sentence to which I wish to direct attention is this:

> "The complete, self-contained, and independent manufacture of aniline dyes within the United Kingdom is essential to the commercial and martial protection of the State."

He next pays a very high tribute to the work that has been done under the High Explosives Department. I will venture here again to quote. Speaking of Lord Moulton's Committee he says:

> "The country will probably never know how much it owes to the High Explosives Department of the Ministry of Munitions, presided over by Lord Moulton, and officered by a body of strikingly able and energetic men, to whose commanding force it is due that the danger from a shortage of high explosives has been so effectively met."

This is great praise and well merited, and must be very gratifying indeed to gas engineers, considering how much their patriotism and professional skill have contributed, and are contributing, to the great results obtained.

In Germany, as is well known, a dye-works was a high-explosive works and *vice versâ*. Mr. Sharp tells us that the works which, with the same raw materials and 10,000 men, were making aniline dyes before the war, have ever since been making, with 14,000 men, high explosives. When Peace comes, will they not immediately turn over these 14,000 men in that particular works again to the manufacture of aniline dyes?

No doubt a very forward step in the direction of restoring the synthetic dye business to England has been taken by the Gas Light and Coke Company, a full account of which may be read in the admirable speech of the Governor, Sir Corbet Woodall, at the last half-yearly meeting of the Company. But action is necessary in regard to the whole of the production of benzol, toluol, and the acids throughout the country. Mr. Sharp indicates that a great deal has been done for the production of all these materials, and that the Government has especially expended large sums of money on acid production. He asks very pertinently; Are all these works now to be scrapped? I venture to ask, in like manner, if the excellent results which we have discovered can be obtained by the use of the Carpenter process and other means, are to be no further developed when the war is over, when it would be so easy to divert the whole of these products into a new channel and place in the hands of England a power in peace or war of incalculable advantage? This power now is ready at the door of the British people. It is only necessary to realize what it means first, and then set about organizing the methods for grasping and guarding that power in our own hands.

I will not venture to presume here to lay down any scheme as to how this should be done; but I would venture to make one small suggestion—that in the first place the Council of the Institution of Gas Engineers should take the matter fully into their consideration, as to how best the Institution and other of our own Associations, dye users, dye producers, and tar distillers could be brought into co-operation with the least possible delay, in order that Parliament should be induced to take action before the terrible words "too late" are written over the doors of a lost opportunity of such magnitude.

Thos. Canning, Engineer,
Newport Gas Company.

Newport (Mon.), March 1, 1916.

Gas Companies as Owners of Collier Vessels.

Sir,—As some observations of mine at the general meeting of the Commercial Gas Company do not appear in your report, and as they are, I consider, of considerable interest to your technical readers just now, when the ownership of collier vessels is spreading among the larger companies, I shall be glad if you will let me say that the employment for their sole use and at terms of interest on capital by the Commercial Company (practically owning these vessels) was inaugurated as long ago as 1886 for ships capable of discharge at the only river staith that the Company had at Wapping. These ran very profitably; the freights, charges, and agency to the manager (a Mr. Suart) being for the year 1887 under 2s. 9d. alongside. The contractors for the provision of ships were Messrs. F. Green and Co.—the firm of now Sir Frederick Green.

But the development of gas making at the Poplar works, on the River Lee, made it expedient to consider the employment of smaller vessels—such as could penetrate the creek windings and the bridges. These were not to be contracted for, as they would be useless for general traffic; and the Company faced the proposition of building at their own capital cost. So in 1900, two years before my retirement, one of the former vessels, the s.s. "Poplar," 1350 tons, was bought, and two smaller ones, about 650 tons each, successively designed and employed—the s.s. "Commercial" and the s.s. "Bromley." Later the s.s. "Poplar" was sold, and the s.s. "Mile End" put into her place. The drawback of the smaller steamers is the extra cost of wages, provisions, engine stores, &c., due to the smaller carrying capacity in later years, accentuated by the rise in cost generally under all these headings, and in war time largely again increased as the Chairman explained.

For now a good many years the Wandsworth Gas Company have had successively one, two, and three steamers running at great advantage, because (like the Commercial's Poplar vessels) there is at least saved 1s. on loading and 6d. to 9d. barging for those who cannot use the steam-vessel direct. But war freights are driving the larger companies to the same practice; and it will be an illustration of the old proverb that "out of evil cometh good," for from thirty years' experience I know that by the sliding-scale it will spell cheaper gas to the community for all time ahead.

The difficulty of building and working the boats was less to the writer than that of convincing Directors—who were some timid, some shortsighted—of the value of the scheme.

Fortunately, the present Chairman took great interest in the scheme, and went with the writer to the trial trips of the first two steamers built for the Company.

Hy. E. Jones.

Palace Chambers, Westminster, March 4, 1916.

Broadstairs Gas Company.

Sir,—After the receipt of the 1914 report of the above-named Company I felt constrained to write the letter you published in the "Journal" for May 4 last year, p. 283.

Judging by the report now to hand for 1915, I am only sorry I kept my deeper thoughts to myself at the time; for the latest statement of the Company's working makes very unwelcome reading. In short, close and immediate investigation of its affairs appears to be vitally necessary.

Although on a much smaller scale, one cannot help comparing the present position with that of the Alliance and Dublin Gas Company in the unfortunate phases of its career when criticism first came from my pen. Before its reorganization, the Dublin Company did not pay its full statutory dividend; and Broadstairs is in like state. To me that is sufficient comparison to warrant reorganization in this case; for when a sliding-scale company fails to manage its business in such a way that dividends in measure with the price of gas charges to the public are impossible, then there is something radically wrong, and the Company's "house" wants "putting in order." Now from the letter above referred to it will be seen that so recently as January, 1915, the ordinary "D" stock of the Broadstairs Company was offered as bearing 7 per cent. dividend "free from tax." On the then selling-price of gas—viz., 3s. 3d.—a distribution at the rate of 9 11-40ths per cent. was permissible. Incidentally one should mention it was submitted that the 7 per cent. free of tax was equivalent to a dividend of £8 per cent. less tax (then standing at 2s. 6d. in the pound).

My surprise, therefore, when a few days ago I received the report and accounts for 1915, is difficult to express. The reason is not far to seek. Thus the dividend proposed on the 7 per cent. stocks ("B," "C," and "D") is 1 per cent., less tax; in other words not ⅞ per cent. What will the feelings of the investor of January, 1915, be with the lurement of 8 per cent., less tax, and the result—a drop of over 7⅛ per cent. for the year? The above announcement is also accompanied by this strange anomaly—namely, that it is proposed to pay 4 per cent. on the 10 per cent. "A" stock, whereas on a *pro ratâ* basis the dividend should be £1 3/7ths per cent. Why this curious nursing of the "A" stockholders, who get 40 per cent. of their previous year's dividend, while the others are to be put off with some 14 1/3rd per cent.? An explanation is surely necessary; and it is for the shareholders at the forthcoming meeting to see that one is given.

However, the point to which I wish to draw particular attention is the general conduct of the undertaking. The principle truly controlling sliding-scale companies is apparently ignored; and the manner of fixing dividends and the price of gas fortuitous and unsystematic. In this connection, I need only instance the fact that up to July last year the price of gas was 3s. 3d.; to-day it is 4s., and yet we know the unfortunate result.

The standard price per 1000 cubic feet in the case of this Company is 4s. 4d., at which selling price the dividends of 10 per cent. and 7 per cent., according to class of stock, should be paid. If circumstances at Broadstairs are so exceptional that gas cannot be sold at a low figure, then, to point the moral of my letter of last year, the price should be fixed to yield a revenue sufficient to cover working expenses and yield the statutory dividends. Without going into details, I estimate that, with gas at 4s. 6d. per 1000 cubic feet, the Company can meet the expenditure and (on the sliding-scale basis applying) pay £9 10s. per cent. on the "A" stock and £6 13s. per cent on the remaining classes.

At any rate, something must be done to stop the downward tendency of the Company's affairs. Unfortunately, travelling is difficult in these strenuous times; but I would ask for a rally of shareholders at the approaching meeting, so that measures may be developed to stop the "dry rot" that has evidently set in.

R. W. Edwards ["Nonulus."].

Brooklands, Aldershot, March 3, 1916.

Mortgage Bonds.

Sir,—Owing to the present extraordinary prevailing conditions with regard to rates of interest for money or mortgages caused through the war, it is my personal experience (being an officer of a statutory gas company) that many bondholders are now naturally desiring higher rates of interest upon their loans than heretofore. Consequently, my company have since the commencement of the war been renewing same at a higher rate of interest upon a six-months' notice of repayment on either side, without specifying any term of years. Therefore, as the "national" rates of interest are being increased for various purposes from time to time, bondholders observing same give us the necessary notice for repayment of their money or an increase in the rate of interest. To retain same, the concession has to be made. Our procedure, consequently, has been to prepare a new bond in each case, stamped at the rate of a substituted security; but seeing how often this is being repeated, I would like to know, if possible, if the issuing of such new bonds could not be legally overcome by an endorsement upon the back of the existing bonds every time an alteration is made in the rate of interest.

I would be obliged if any of your readers would give me, through your columns, their experience under similar conditions.

March 1, 1916. ENQUIRER.

Showroom Reform.

SIR,—I venture to ask your further indulgence in reply to the letter of Mr. Cyril Davis in your last issue.

I am sure the thanks of all showroom attendants are due to him and also to your courtesy in allowing us all the use of the columns of the "JOURNAL" to state our case.

There is, in my opinion, so much which is good in Mr. Davis's letter, that one hardly likes to criticize the remainder. But I cannot help thinking that he is skating over rather thin ice when he suggests "that showroom experience should be regarded rather as a means to an end, than an end in itself." I would far rather take the standard he himself sets up in his admirable article on the 8th ult. I would ask : Are there appointments waiting outside the showroom for all those who excel in that department? If so, What are they? No; let us deal with realities. One cannot find a solution by simply saying "that the position of the showroom attendant is probably no worse than that of men engaged in any other sphere of activity," because that is a purely hypothetical statement which might be analyzed. There, together with the absence of a status, lies the crux of the whole case so far as we are personally concerned.

All we ask for is a "Place in the Sun;" a recognition of initiative; a desire shown openly of "co-partnership" in reality; an appreciation of work well done under, sometimes, very trying conditions; and, finally, that word of praise which is worth its weight in gold.

March 1, 1916. A SHOWROOM ATTENDANT.

SIR,—May I be permitted to add my appreciation to the excellent articles by Mr. Cyril G. Davis on the above subject. I hope he will see his way to have them reprinted, and that all gas undertakings will present a copy of each to every member of their selling staff.

The letters of "Fair Play" and "Another Showroom Attendant" are quite outside the spirit of Mr. Davis's remarks. If we attain to the all-round efficiency which these articles advocate and so ably describe, we shall be able to command a position of dignity and authority, with its accompanying increase of salary.

Such a one could not be crushed; for he would win the approval of all he came in contact with. And, after all, it is what the consumer and (through our efficient treatment of his or her wants) what our chief thinks of us, that counts; not what we think of ourselves.

I am convinced that the real road to showroom reform lies primarily in bringing those of us who are privileged to work in the showroom up to the standard of efficiency set out so admirably in these articles. The salesman who has thus equipped himself would always make his showroom a real selling power, whether its architecture were ornate or not in its character.

Perhaps an additional outcome of the increased study of the subject will result in the formation of an "Association for Showroom Salesmen," which would enable members to benefit by an interchange of ideas, and by means of which correspondence courses in the science of salesmanship be made possible for those who are both keen and shrewd enough to undertake them.

NORTHERN SHOWROOM MANAGER.

Feb. 28, 1916.

An Increased Output at Exeter.

The report presented at the annual meeting of the Exeter Gas Company—Mr. G. Hardy Harris presiding—showed an increase in the sale of gas of more than 18,000,000 cubic feet, or just over 4½ per cent., for the year. The payment of 10 per cent. per annum on the £40,000 original stock, and 7 per cent. on the £46,500 new ordinary shares, was recommended. The Directors much regretted that Mr. W. R. Moore had resigned his seat on the Board, and stated that they had elected Mr. Joseph C. Wippell to fill the vacancy. The revenue account showed a profit of £11,094; the expenditure being £71,455, and the receipts £82,539. The Chairman, in moving the adoption of the report and accounts, said, considering the circumstances of the time and the general dislocation of trade and of established customs, the Company had reason for congratulation on so satisfactory a report. Coal had not only risen to an enormous price, but was very difficult to get, and labour was scarce. Of their employees, 32 per cent. had gone away in the service of their country. He did not suggest that it would be possible to maintain the large increase which they made last year. Not only must they expect private consumers to use less gas for lighting and heating, but the reduction of street lighting had been effected by practically the exclusion of gas-lamps; the Corporation naturally preferring to retain the electric lamps which they supplied. The income from residuals was largely increased because the price of coke was high, and they had at the beginning of the year an unusually large stock, which was now practically exhausted. He expressed the hope that the cost of both coal and freights would decrease. In response to the request of the Government, they had put down the necessary plant for the extraction of all the possible toluene from the tar. In this connection, he desired to make it known that the price paid by the Government for the product did not recoup the Company for the outlay on plant and labour. After paying a dividend at the same rate as last year, a balance of £874 was transferred to reserve. The report was unanimously adopted, and dividends for the half year ended Dec. 31 were declared as follows: Four per cent. on the preference stock, 5½ per cent. on the preference shares, 7 per cent. on the new ordinary shares, and 10 per cent. on the original stock. The Chairman acknowledged the valued co-operation of the Secretary (Mr. W. N. Westlake) during a year, when circumstances had thrown considerable additional responsibility upon him, and also paid a warm tribute to the loyal help rendered by the Works Manager (Mr. Wood) and other members of the staff.

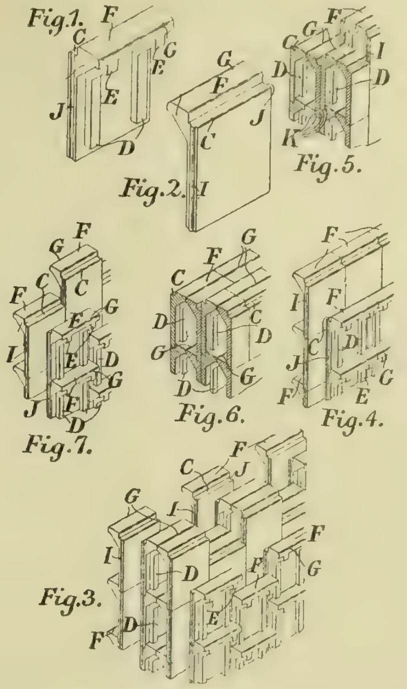
REGISTER OF PATENTS.

Regenerator Chambers in Carbonizing Plants.

GROVE, H. E., of St. Kilda, and BARKER, F. G., of Camberwell, Victoria.

No. 1738; Feb. 3, 1915.

This invention has been devised "to provide means by which a more satisfactory construction of a certain portion of a gas making or carbonizing plant may be carried into effect." The patentees have designed a specially-shaped and fortified tile from which the lining or wall separating the exit for the spent gases from the incoming air is constructed—"the tiles in their arrangement forming double-keyed vertical joints and at the same time permitting a thin wall of a good heat-conducting material to be employed."



Grove and Barker's Regenerator Flues for Retort-Settings.

Figs. 1 and 2 are a front view in perspective and a rear view of the front of the tile referred to. Figs. 3 to 7 illustrate the method of setting employed.

The tile is about 17 inches in height by 1⅞ inches thick across its vertical section, and widening out towards the top to a width of about 6 inches, and having a face approximately 12 inches wide. Along the upper portion, a part C (preferably about 2 inches deep) is channelled out to enable the bottom of the next tile above to fit and form a key. Two vertically placed webs or ribs D are formed in the inner (or front) face of the tile—*i.e.*, proceeding from the portion of 6-inch width at the top to within about 2½ inches from its bottom; so that the end of each rib terminates slightly above the top face of the next lower tile. The upper portion of the rib bends inwardly at E to a central vertical line, so as to meet a rib of an opposite tile of similar construction. The top flat faces F of the two meeting tiles form the floor of each particular flue through which the inlet air passes in a baffled travel to the producer vents. The inner top edge of each tile is slightly splayed oft. On the two splays meeting, a downwardly pointing V-shaped channel G is formed, which is filled with fire clay or other stopping to close the meeting edges of the two oppositely arranged tiles. A continuity of these tiles (as shown in figs. 3 to 7) is employed to the required height for supplying air to support combustion at the producer exits; and a similar parallel vertical arrangement is employed through which the outgoing heated gases escape downwardly in a sinuous or baffled travel.

The parallel sets of inlet and outlet passages are placed against one another (in their vertical setting), and the joints of one set are stepped at such a height from the adjacent set that the channelled keyways in the one set are a few inches higher than those in the adjacent set—"thus avoiding the escape of incoming air into the spent escaping heat fume ducts leading to the chimney flue." There are thus five separate faces K containing fire-clay between the incoming air and the outgoing gases in the keyed tile settings. The channels C, and the lower portions of the tile fitting therein (producing these five faces), completely obviate any commingling of the incoming air with the escaping gases, but, nevertheless, allow a comparatively thin wall (say, 2⅞ inches) of material for the heat to pass through, or radiate into, the inlet air.

One end of the front face of the tile (approximately 12 inches in width) is rebated at I to correspond with a concave or groove J on the opposite edge of the next tile, so as to form a bond.

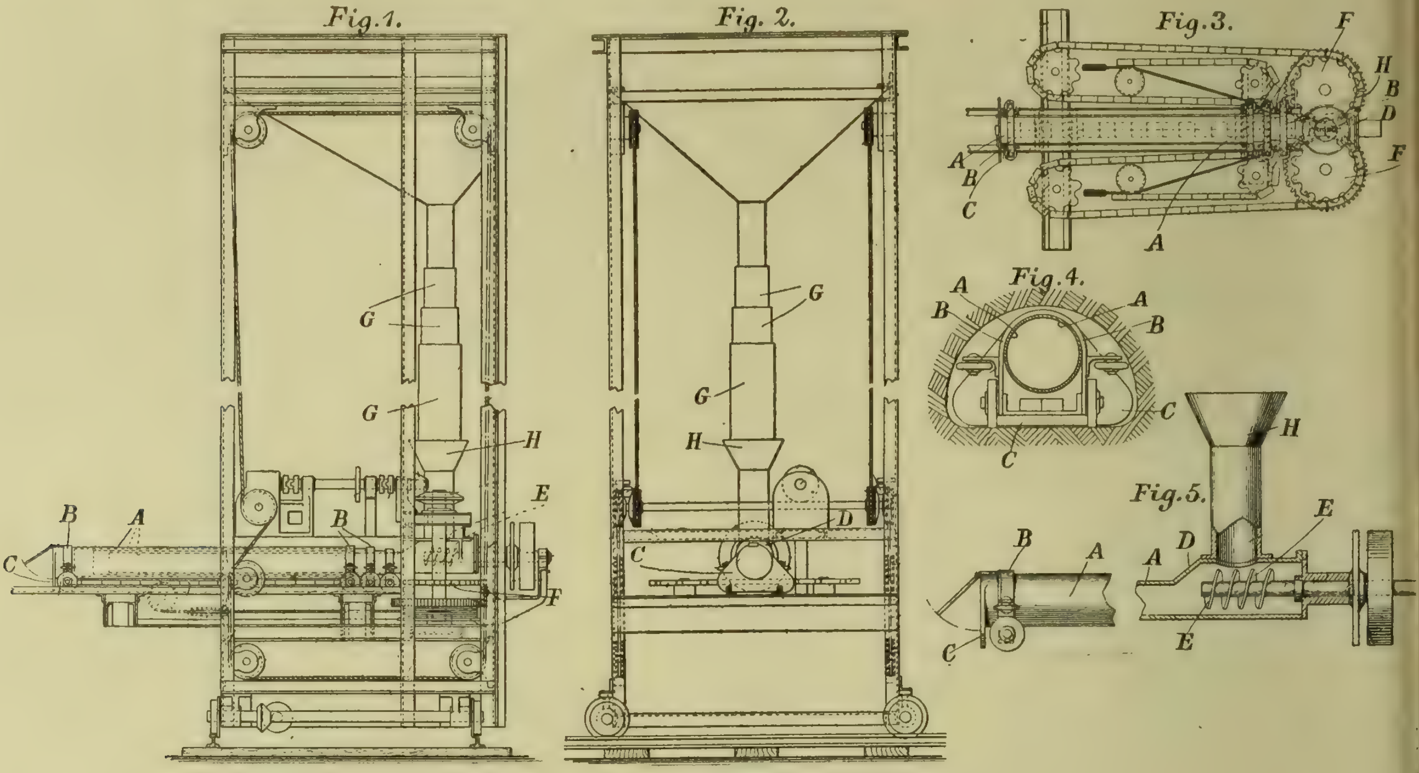
From the top of the vertical arrangement for the incoming air a curved conducting flue is led up each side of the arched top of a producer furnace, "so that the heated air joins with the exuding producer gas and proceeds along a horizontally placed flue running in parallel arrangement with the retorts." The mixed gases form "a flame that proceeds upwardly along one side and under half the bottoms of the retorts, and, after passing over the latter, finds its way downwardly into a vertical duct leading to the main chimney flue."

Charging and Discharging Gas-Retorts.

Fiddes, W. J., of Tottenham.

No. 2340; Feb. 13, 1915.

This invention relates to apparatus for "charging and discharging gas-retorts, coke-ovens, and the like, or for conveying coal or other materials."



Fiddes's Gas-Retort Charging and Discharging Apparatus.

Fig. 1 is a side elevation of the apparatus. Fig. 2 is an elevation of the end next the retort. Fig. 3 is a plan of the mechanism for operating the telescopic tubes and bar forming part of the invention. Fig. 4 is a section looking into the mouth of a retort. Fig. 5 is a side elevation of the feed hopper.

A series of telescopic tubes A (preferably circular) are provided with a carriage B carrying rollers to support the tubes, attached to brackets on the sides of the carriage. The end of the outside section of tube is fitted with a flap lid, hinged so that it hangs vertically and can only swing outwards. This outside section of tube may, in addition, carry the usual front push plate C for driving the coke out of a through retort. The tubes are carried on a track while collapsed and on the machine. Attached to the innermost tubes is a casing D, in which is a filling or thrusting device consisting of either a reciprocating plunger, an endless band or chain, conveyor, or (as shown) a revolvable screw E, the spindle of which is attached to a flywheel which gives impetus to the screw.

Near the back of the apparatus are two drums F (carrying chains), preferably placed close together, so that they may be conveniently connected to the carrier of the front end section of the telescopic tube. Each chain is constructed so that it can only be wrapped in one direction, and is so positioned with regard to the other drum that, when placed side by side, the two form "a rigid bar incapable of being bent from any cause" By applying power to the drums this chain rod is actuated and the tubes are pushed out to their full length, and drawn back at what speed may be desired.

To enable the chains to be moved backwards and forward to push out or draw in the tubes and "to economize space as much as possible," the chains, after being passed round the drums F, are conveyed to similar drums journalled to a bracket on the front end of the machine (see fig. 3) and then back to similar, but smaller, drums near the drums F, around which they are passed, and then alongside the chains between the drums to vertical pulleys fitted to the frame of the machine, where their ends are connected to wire ropes passed over pulleys. Between the drums are toothed wheels meshing together and forming one concrete article—both sets always moving together and in the same ratio.

The coal is supplied to a valved hopper at the top and passed down telescopic shoots G to a hopper H—the shoots collapsing or extending according to the up and down movement of the tubes and their frame to suit the height of the retort. The tubes, chains, drums, gear wheels, power engines, track, gear, and other appliances (except the hopper and telescopic shoots) are carried by a framework capable of being raised or lowered to suit the height of the retort to be operated, and at the same time (through suitable gearing) be moved along a track on the retort-house floor.

The action is as follows: Power is applied to the drums F to drive the chains, together with the tubes A, to which they are attached, into and through the retort to the furthermost end; and coal is delivered from the main hopper into the charging apparatus D. The coal comes in contact with the screw E, or other filling or thrusting device, and is thereby driven forward into the tubes, as they are being extended to their full length in the retort. As soon as the tubes have reached the furthermost end of the retort, the action of the drums F is reversed, and the chains and tubes are withdrawn, during which operation the tubes are telescoped together, the flap lid in front opens, and a continuous delivery of coal into the retort is effected—the screw acting as a resistance to the coal.

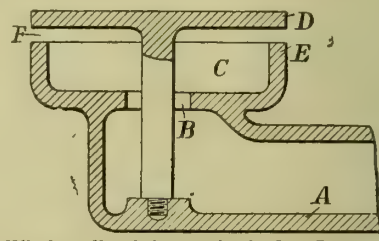
By regulating the speed of withdrawal of the tubes and of the coal feed, the retort can be either lightly charged or absolutely filled with coal as may be desired. And, if desired, the apparatus can push the coke out of the retort by means of the usual push-plate C, in combination with the shut flap lid, which will prevent coke being forced into the tube mouth.

Atmospheric Gas-Burners.

Windemuller, J. H., of The Hague.

No. 2498; Feb. 16, 1915.

This invention refers more specifically to burners of the kind in which additional flame-spreaders are used in conjunction with the mixture-tube. The patentee's previous inventions are No. 2193 of 1903 and No. 6277 of 1911.



Windemullers' Atmospheric Gas-Burner.

A vertical section is shown of a burner (with one inlet orifice and one burning opening) preferably used for household purposes. A is the tube through which the mixture of gas and air is supplied to the inlet orifice B of the expansion chamber C, which is enclosed by a cover D and the bottom plate E. The inlet is very small in comparison with the wide slot F, of great length, between the parts D and E. Yet the flame is said to burn "quietly on such slot without showing a tendency to strike-back."

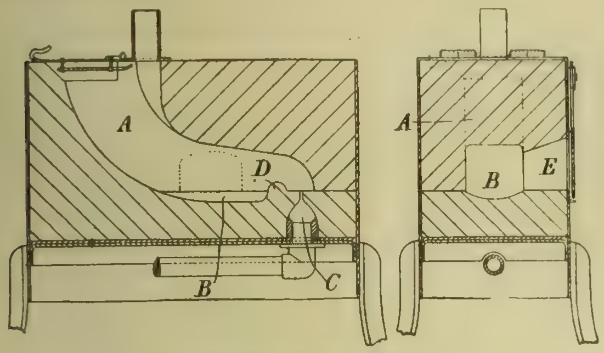
In a domestic burner resembling that shown, the inlet B may, the patentee says, have a diameter of 17 mm. and the stem of the disc D a diameter of 8 mm., so than an annular opening of approximately 177 sq. mm. is available for the passage of the mixture from the mixing tube A to the expansion chamber C. The diameter of the flange E of the mixing chamber may be 36 mm., and the width of the burner opening F may be 4 mm., so that the opening on which the flame burns has an area of approximately 452 sq. mm.—approximately two-and-a-half times the area of the opening B. In such a burner, it is claimed, the flame does not burn within the chamber C, although the burner openings are relatively of such large size that they would not serve to prevent back-flashing of the combustible mixture in a bunsen burner at the pressures at which coal gas is ordinarily supplied for lighting and other domestic purposes.

Gas-Furnaces for Heating Rivets.

Brown, D. A., of Glasgow.

No. 16,906; Dec. 1, 1915.

This invention has for its primary object to provide a hot chamber at the base of a shoot down which a series of articles (say, rivets) may "gravitate in the form of a procession." The characteristic feature of the invention is the provision of a hot pocket at the base of the shoot and opposite a surface impinged on by the flame from a gas-nozzle located within the furnace—the hot pocket being so arranged that its contents are maintained clear of the gas-flame.



Brown's Gas Rivet-Heater.

As shown, the furnace comprises a jacket of highly refractory material (fire-clay), shaped internally so as to present an inclined shoot A, the upper end of which is normally closed by a door for putting in the rivets to be heated, and the lower end formed at B as a pocket for the reception of the rivets. Within the furnace and to one side of the pocket is the gas-burner nozzle C, so arranged that the flame impinges on the adjacent upper wall of the shoot and renders it incandescent. Intermediate the nozzle and the pocket is a rib D, which, while performing the usual function of a furnace bridge, also serves as a guard to prevent the entrance of the rivets at the forward end of the procession into the space reserved for the nozzle. The outlet for this is through the doorway E.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for March 1.]

Nos. 2533—2917.

Atkinson, H. G.—"Taps or cocks." No. 2649.
Bennett, W.—"Purification of coal gas." No. 2860.
Carroll, L. D.—"Coal-gas making apparatus." No. 2783.
Chrisman, C. S.—See Carroll. No. 2783.
Dick, P.—"Taps or cocks." No. 2764.
Fleischer, J.—"Gas heating-stove with superheater." No. 2749.
Haegele and Zweigle.—See Fleischer. No. 2749.
Jackson, A.—"Controlling combustion in coking plants." No. 2909.
Koppers Company, H.—See Jackson. No. 2909.
Macleod, J.—See Bennett. No. 2860.
Sandow, E.—"Appliances for use with gas cooking and heating plates." No. 2799.
Taylor, J. R.—See Atkinson. No. 2649.

APPLICATIONS FOR RESTORATION OF LAPSED PATENTS.

Notice is given that the Ellwhite Gas-Stove Company, Limited, have made application for the restoration of the patent granted to William White for "Improvements in gas-stoves," No. 23,033 of 1910, dated Oct. 5.

Notice is given that William Reavell and Reavell and Co., Limited, have made application for the restoration of the patent granted to them for "Improvement in mechanism for converting rotary into reciprocating motion, applicable to pumps, compressors, and other machinery," No. 17,026 of 1907, dated July 25.

Treatment of Consumers' Meters.

The American Gas Institute have appointed a Committee to obtain information and statistics on the lines of the following list of questions that has been circulated among the members:

1. How long should a meter be allowed to remain on a consumer's premises in a locked-off or not-used condition?
2. How often should a meter be brought in for test?
3. How long should meters be allowed to remain in service which pass very large amounts of gas or which supply a fluctuating load, as, for instance, gas-engines?
4. What is the best maximum size and capacity of meter which should be used?
5. Where meters are set in batteries, what is the best arrangement?
6. What is the best practice in removing meters with regard to the rigid connections and shelves? For instance, is it better to shut the gas off at the meter?
7. Instructions as to handling meters by fitters and also on waggons.
8. What is the best practice of shutting-off the gas when service is discontinued? For instance, is it better to shut the gas off at the kerb or at the lock-cock, or is it best to insert a blind-washer in the union?
9. What are some of the weak points of some of the best meter rigid couplings and meter shelves?
10. Notes containing a "Caution" to those setting meters to make sure that the outlet riser is firmly fastened to a permanent part of the building.
11. A table of "Don'ts" showing where and under what conditions a meter should be set.
12. Under what conditions should a meter which has been brought to the shop for test be allowed to be reset—provided, of course, that it tests satisfactorily?

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

A Bill to confirm a Provisional Order under the Private Legislation Procedure (Scotland) Act, 1899, relating to Aberdeen Corporation Water, was presented by Mr. M'Kinnon Wood last Tuesday, read the first time, and ordered to be read a second time to-morrow (Wednesday).

The District of the River Dee District Board have presented a petition against the above Bill.

LEGAL INTELLIGENCE.

Liability for a Hotel Gas Bill.

The question raised in the Sheriff Court at Airdrie, of whether a party whose name appears on the valuation roll as owner and occupier of a hotel is to be held liable for the gas consumed on the premises, has been sent by the Sheriff-Substitute to probation. The case is that in which the Provost, Magistrates, and Town Councillors of the Burgh of Bridge of Allan sue John Benson, accountant, of Airdrie, for £34 for gas consumed in a hotel in Bridge of Allan. The defender pleaded that he was merely the nominal holder of the property for a bondholder, and that although his name was, by arrangement, put on the valuation roll as the occupier, it was simply to meet the requirements of the Assessors, who required some one to be entered as owner and occupier. He further pleaded that the hotel, during the period covered by the account, was occupied by a former manageress for her own behalf, and that he never occupied the premises nor consumed the gas. After hearing the law agents of the parties, Sheriff Lee has repelled their pleas in law so far as preliminary, and allowed parties a proof of their averment. His Lordship said that if the only ground of alleged liability for the charges made upon the defender was the entry in the valuation roll of defender's name as occupier, he was of opinion that the action would not be relevant. He was not prepared, as at present advised, to lay much stress upon the provisions of section 45 of the Burghs Gas Supply (Scotland) Act, 1876, which defender's agent seemed to think required the Gas Commissioners to have a written contract or request for the supply of gas as the foundation of any claim for charges. This section seemed to have been framed to meet the case of persons, not hitherto supplied, requesting a supply by an extension of the section to include their premises; and his Lordship doubted whether it was applicable at all to the circumstances of this case, but thought it clear that, unless the pursuers could allege a contract with the defender, or that the gas was supplied on his credit, their only claim against him for these charges must be as a consumer of the gas charged for. It was because the pursuers averred that the defender was, during the period of the account, in fact the occupier of the premises and the consumer of the gas that his Lordship thought their case was relevant. As the parties were at issue on a relevant question of fact, a proof must be allowed, and pursuers were appointed to enrol the case for the purpose of fixing a diet.

Chelmsford Gas-Works Purchase.

The report submitted at the annual meeting of the Chelmsford Gas Company congratulated the stockholders upon another very successful year. The price of gas was reduced by 2d. per 1000 cubic feet from Jan. 1, 1915; and notwithstanding this reduction and the increase in the price of coal and wages, the gross profit was £2083 more than in the previous twelve months. This was mainly due to the large increase in the quantity of gas sold—namely, 15 9 per cent.—and to the better price they obtained for residuals. As the Company were now working under a sliding-scale, the Directors were able to recommend a dividend for the year at the rate of 5¼ per cent., instead of the standard rate of 5 per cent. An interim dividend at the rate of 2½ per cent. had been paid, leaving a balance of 2¾ per cent. for the final dividend. The Town Council had given notice of their intention to purchase the gas undertaking; and proper steps would be taken to ascertain the price to be paid for it. As the Corporation were not able to borrow the purchase-money until twelve months after the termination of the war, they would take over the works when terms had been arranged, and pay interest, half-yearly, at the rate of 5 per cent. per annum on the purchase money, which sum would be distributed by the Directors, who would remain in office to look after the interests of the stockholders. New retorts had been installed to deal with the extra demand for gas; and an additional gasholder was in course of construction.

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Satisfactory Progress at Newport (I.W.).—The report presented by Mr. R. Pinnock, J.P., who presided at the annual meeting of the Newport (I.W.) Gas Company, on the 25th ult., stated that the gas sales showed an increase of 3¼ per cent. on those of the previous year, which, having regard to the adverse conditions of lighting prevailing consequent on the war, might be considered satisfactory. The works had been insured against aircraft damage and bombardment. The payment of part wages to dependants of employees on war service had been continued. Owing to the enormous increase in the price of coal, the Directors were compelled to raise the price of gas 4d. per 1000 cubic feet from April 1. The continued high cost of coals and freights was still a source of anxiety; and as it seemed unlikely that any relief could be expected during the war, it might become necessary still further to raise the price of gas. The Directors recommended the payment of a balance dividend of 2 per cent. on the preference stock and 3 per cent. on the ordinary stock—making, with the half-yearly interim dividend, 4 and 5½ per cent. on the respective stocks, which are the maximum dividends payable at the existing price of gas. The report was adopted.

MISCELLANEOUS NEWS.

DYES AND HIGH EXPLOSIVES.

Addressing the shareholders of the Bradford Dyers' Association on Monday last week, the Chairman (Mr. Milton Sharp) referred to what he described as the startling fact which the war had revealed to the thoughtful mind and impartial eye of every intelligent man who had been brought into direct contact with the difficulties arising from the shortage of aniline dyes—namely, that the establishment of the synthetic dye industry in this country was vital to national safety. To the uninitiated it might seem very strange, but it was a simple fact, that dyes and high explosives were very closely co-related. Benzol, toluol, carbolic acid, sulphuric, and nitric acids were the raw materials from which dyes and high explosives alike were made; and it would indeed be a tragedy if the English failed to learn the lesson the war had taught them—that ability to produce unlimited quantities of these articles was one of the first essentials of any hope of success in warfare. The complete, self-contained, and independent manufacture of aniline dyes within the United Kingdom was essential to the commercial and martial protection of the State. The raw materials from which aniline dyes were made being the same as those used in the manufacture of high explosives, let them picture to themselves the enormous advantage Germany had by reason of her huge, highly-organized, and ably-administered colour-works, producing all the raw materials required for the making of high explosives, and able immediately to divert much of the colour-making plant to their manufacture. What was this country's position? They had to improvise an Army. They had also to improvise the production of high explosives.

AFTER THE WAR.

The country would probably never know how much it owed to the High Explosives Department of the Ministry of Munitions, presided over by Lord Moulton, and officered by a body of strikingly able and energetic men, to whose commanding force it was due that the danger from a shortage of high explosives had been so effectively met. Referring to the extension of munition works, the speaker said most of such extensions had been made to serve a temporary purpose only, and at the end of the war would be demolished, unless such portions were retained as could be utilized in producing the bases for aniline dyes. Some were of a permanent character, especially those in connection with acid plants, on which the Government directly and indirectly had spent tremendous sums. These also would be useless and valueless after the war unless the colour industry was established in this country, to which end such plants were a long and essential step; and it would be little short of criminal folly to break them up. He desired to urge with all the force with which he was capable that this country must never again jeopardize its national safety by the risk of shortage of high explosives, and that, whatever it involved, they must establish the aniline dye industry in this country, so that in case of war the country would have the ability to quickly produce any amount of high explosives the Army or Navy might need. Until this was done the nation would always be at a great disadvantage as compared with Germany. He was confident, if public opinion could once understand the situation, it would be practically unanimous in demanding the most thorough-going and drastic action, quite regardless of cost.

OCCUPATION IN PEACE AND WAR.

On his last journey to Germany, just before the outbreak of war, he visited all the large colour-works; and it would bring home to them what terrible instruments such works were for enabling the German Government to carry out its policy of "frightfulness" when he told them that one company alone, then employing about 10,000 men, chiefly in the manufacture of aniline dyes, to-day (he was credibly informed) were employing 14,000 men almost entirely on the manufacture of high explosives. Only those with some knowledge could realize the facility with which a colour-works could be converted into a high-explosives factory. Another works visited at that time employed about 9000 men in the manufacture of aniline colours and pharmaceuticals. He had information, to which he attached entire credence, that to-day these works were engaged almost solely in making T.N.T. and picric acid for the German Government. During the course of the same journey he gathered that 75 per cent. of the collieries in Germany had coke-ovens installed. When it was realized how vitally important the distillation of coal in coke-ovens was in relation to the manufacture of aniline dyes and high explosives, it would be seen how this alone gave Germany an enormous advantage over us in the early stages of the war, as the bye-products from the coke-ovens were among the most important materials for making colours and explosives—whereas in Great Britain at the outbreak of war only some 25 per cent. of the collieries had coke-ovens installed.

AMMONIA AND NITRIC ACID.

He was also told that three of the principal German colour-making concerns, who pooled their profits, had shortly before increased their capital by £2,250,000, for the purpose of erecting works for the production of ammonia from the air. At that time they estimated they would produce 130,000 tons of ammonia per year; it had since been stated that this production had been increased to 200,000 tons, and was now being converted into nitric acid. The raising of so much capital for such a purpose was noteworthy even on the surface; but it was even more striking in the light of the now certain knowledge as to the preparations of Germany for war. It was impossible to avoid the conviction that the use of such a plant in the event of war was duly taken into consideration. It had been said that the supply of high explosives to the German Army would by this time have ceased had it not been for this plant. It was quite possible that the stocks of nitrate of soda would now have been exhausted; and without nitric acid, no high explosives could be made. It was many months after the outbreak of war before it was seen by us that high explosive shells would be the dominating factor. Germany, realizing the failure of her fond hopes of a speedy triumph, knew quite well what the character of the warfare would be; and her possession of huge colour and chemical works enabled her to set about immediately producing almost unlimited quantities of high explosives. This country was in no such position—we had no works in the slightest degree comparable with the great works in Germany. Experience proved how essential it was to the national safety that such works should be established here, and illustrated the folly of which we had hitherto been guilty in materially aiding the development and prosperity of those works in the country of a potential enemy.

DYE USERS AND DYE PRODUCERS.

How could this establishment be accomplished? No one with any knowledge would venture the opinion that it could be attained through British Dyes Limited alone. He wished to speak with great respect and the deepest gratitude for what that Company had done. Faced with a tremendous task, made incomparably more difficult by the prior claim of explosives upon the raw material, it had done really splendidly. The want of raw materials had hampered the efforts also of all the British, Swiss, and French makers. And when such difficulties disappeared, he was sure British Dyes Limited would not claim that they alone would have the power to free us from German domination in this the greatest "key" industry—a key, not only to export business aggregating £200,000,000 a year, and to the employment of some 2,000,000 people, but, what was of far greater moment, also to the national safety. Indeed, there were few things which this terrible war had made more clear than that, both from the economic and national defence standpoints, there was no question of greater urgency than the rapid establishment of the aniline dye industry in this country. It certainly called for further and immediate action by the Government and Parliament; but before he indicated the form such action, in the opinion of the Directors, should take, he would like to point out ways in which assistance of great value could be given to British, Swiss, and French colour makers.

A COMMISSION FOR THE ESTABLISHMENT OF THE INDUSTRY.

In the first place, he would urge greater sympathy and closer co-operation between dye users and dye producers. By a very simple process the allied Governments could do much to aid British, Swiss, French, and Russian colour makers by entirely prohibiting the use of any German dye on goods used in any Government Department. The policy which the Directors favoured was practically that which they urged upon His Majesty's Government before the formation of British Dyes Limited, and which, stated in the briefest terms, was that the Government should make a grant-in-aid of (say) £500,000 per annum for a period, to be administered by a Commission charged with the duty of securing the establishment of the industry in this country, by grants on production, and for enterprise and initiative. The number of the Commission should be limited, and its members carefully chosen so as to unquestionably command the confidence of the British, Swiss, and French colour makers, and of the users, who could give invaluable aid. If this were so, it would make possible what, without it, would, he feared, be quite beyond reach—namely, a definite unity of purpose by the proper co-ordination of production and the mutual supply and exchange of raw and intermediate products.

Such a Commission, provided, as it would be, with special means for the fulfilment of its mission, and by enterprising, energetic, and fearless leadership, watching with the utmost vigilance the progress of the various colour-making works, would, in the opinion of the Directors, secure the establishment of the industry in this country, not only on less debatable lines, but also much more quickly than by import duties; and, even in the event of the imposition of such, the saving of time would be well worth the cost for two or three years.

Under the heading "Solving the Dyeware Problem," the following remarks appeared in the "Yorkshire Observer" for March 3: The dyeware difficulty is being gradually modified. The output from the works of British Dyes Limited, of which Messrs. Read Holliday's works now form a part, has steadily increased, and is now quite double that of just before the war. It is fitting that contributions to the solution of the problem should emanate from Huddersfield, which now becomes the chief centre in the country of the dyestuffs industry. It will be remembered that Messrs. Lodge and Evans, of Huddersfield, invented a new dyeing process, of which some advantage has been taken. Now, it is reported, a new discovery has been made in connection with the production of aniline dyes; and this is likely to have an important bearing upon the work which British Dyes has undertaken. For some time past experiments have been carried out at the works of Messrs. James Robinson and Co., Limited, of Hillhouse Lane—one of the oldest colour manufacturing concerns in the country. These experiments have, it is claimed, been so successful that the firm are convinced of the utility of the new departure. Its possibilities cannot as yet be fully demonstrated, however, owing to the limitation of the supply of materials due to Government requirements for explosives. The nature of the discovery can only be vaguely hinted at. It lies in certain chemical processes which are constantly recurring in colour and dyestuffs production, and the operation is effected by hitherto unknown means. It is claimed that there will be a great saving in the cost of production, and that the discovery opens up a new method for the preparation of a new series of dyes.

South Metropolitan Gas Company's Lady Superintendent.—The March issue of the South Metropolitan "Co-Partnership Journal" has, as a frontispiece, a portrait of Miss M. H. Fawcett, who, it is remarked, occupies a position which has been created by the circumstances brought about by the war. When it was decided that, during the absence of certain co-partners on Imperial service, some of the work of the offices and district should be done by women, Miss Fawcett, who was already an officer of the Company, was called upon to aid in the selection of suitable candidates, and subsequently to act as Lady Superintendent. In this capacity, she has the supervision of over 130 employees, of whom 45 are clerks, 17 are showroom assistants, 54 are index-readers, and the others are engaged in the maintenance, slot-meter, and chemical departments.

WANDSWORTH, WIMBLEDON, AND EPSOM GAS COMPANY.

The Half-Yearly Meeting of the Proprietors of the Company was held last Tuesday, at the Westminster Palace Hotel, Victoria Street —Mr. H. E. Jones in the chair.

The Secretary (Mr. Chas. W. Braine) read the notice calling the meeting; and the Directors' report and the statement of accounts were taken as read.

Effects of the War on the Undertaking.

The Chairman, in moving the adoption of the report and accounts, said they met again with the war still fiercely raging. In the first place, he wished to tell the proprietors how the Company had so far been affected by the war. Their employees to the tune of 32 per cent. had joined the Colours. He was sorry to say the names of thirteen of the men were on the roll of honour, eleven were wounded, and five were prisoners of war. This, on the one side, was a proud position; on the other side, it was a sad record. The war had also thrown upon the Company many burdens and many difficulties. As gas proprietors, they all knew the story; it had been repeated at many gas company meetings. There was first the difficulty that had obtained of freights at anything like reasonable rates. This very common experience was not shared by the Company. For many years they had had their own ships; and fortunately their own Engineer was able, at the beginning of the war, to find them a spare ship. The two ships that they formerly had would not—owing to all the difficulties and obstructions caused by the war—have been sufficient; and they would have required 50 per cent. more power to accomplish the same duty as previously. The proprietors were also aware that the Company were in the honourable position of being able to furnish for the defence of the country some of the most important explosives; and this they had been doing for a long time past. Through the energy of their officials, he might say that within a week of the authorities intimating that they would require some of these explosives, they were extracting them by the use of some plant which they had available, and which their Engineer at once put into operation. At the present time, they were completing further plant for carrying out the process to a higher degree. He was glad to be able to say that they were getting the plant together without the intervention of contractors. They were building it on a plan which had been approved, and found most successful. It was that adopted by Mr. Charles Carpenter, D.Sc., the Chairman of the South Metropolitan Gas Company, and was a beautifully simple and efficient system. This plant would be in operation long before the next meeting of the proprietors, because it must be got together with despatch and with all sacrifice to enable the country to overcome the enemy. He was sure, he was speaking the sentiments of the proprietors when he said the Directors had not hesitated, and would not hesitate, to incur any expense, trouble, or sacrifice to help the Government in the defence of the country. He believed that he had told the proprietors on a previous occasion that their Engineer (Mr. Carr) was devoting a large part of his time in the service of the High Explosives Committee, of which Lord Moulton was Chairman, by visiting the gas-works in the South of England, for the purpose of seeing that they were efficiently working in the same direction as he (their Engineer) had been doing at the Company's works for a long time past. Though the Company lost the benefit of part of Mr. Carr's services, the country gained more than the Company lost. However, the rapid and efficient production of explosives was much more important than that the Company should make a larger profit or that the consumers should get the last "ounce" out of the gas. He might tell the proprietors, with regard to any profit that might attach to them from what they were doing for the High Explosives Committee, that the return from tar was rather less than this time last year, so that clearly there was nothing hanging to what they were doing in the interests of the country.

SALE OF GAS AND INCREASED USE OF GAS-FIRES.

It would be seen from the report that the Directors recommended the full statutory dividend in accordance with the increase in price of gas that was made last year. The proprietors would no doubt be anxious to know how this profit had been made. In the first place, the sale of gas in the half year—in spite of the prohibition of lighting which not only interfered with the public lighting, but which prevented the traders presenting their goods in their shop windows in the customary fashion with a good light—exhibited an increase of ½ per cent. over the corresponding period of 1914. During the half year, they had connected a large number of new consumers—738—who would, under other circumstances, have given them a large increase in gas consumption. There was also the amazing fact that 2514 stoves had been added to the Company's services. Formerly they had only 63,000 stoves in use. To have had such a large increase falling upon them at a time when they were very much handicapped through shortness of labour, and when it was very difficult indeed to get stoves from the makers, proved that there must have been some extraordinary factor at work, and this factor he had not the slightest doubt was the high price of coal, and the apprehension that was felt by the public that they might not be able to get coal at any price, whereas they knew that, having a supply of gas in the house, they could with the assistance of the Company add stoves for heating purposes, and so make themselves independent of the cost, delay in delivery, and perhaps insufficiency of coal. This was one of the most remarkable effects of this flat depressing time of war. When the war was over, and in ordinary times—for this had been on the whole a mild winter, which he was glad of for the sake of the poorer of the people—this access to the appliances for burning gas for heating would have produced a large increase in the consumption, instead of the small fraction of increase he had mentioned.

A LARGER PROFIT AND OTHER FINANCIAL FEATURES.

Now as to the dividend. The proprietors would find a profit of £38,863 had been made, against £26,400 in the corresponding period of 1914, when they were £10,000 short of the amount necessary to maintain their position, and pay the full statutory dividend. The proprietors would find that even last half year, they did not make sufficient to pay the full statutory dividend by £5000, so that even the £12,450 surplus did not really quite meet the whole deficit of the previous two half years. Until they raised the price of gas 4d., they were selling gas below its real value; and nobody could look upon their dividend as anything but a fair return on their small capital. This result had been accomplished—and this he was always anxious the proprietors should understand—without any parsimony, or cutting-down of the cost of repairs. For the repair and maintenance of the works and plant, they had spent £24,700, against £21,125 in the corresponding period of the previous year. But, comparing these two figures, it must be remembered that everything in the way of material was now much dearer, wages were higher, and labour was difficult to get. It would also be recollected that they had a suspense account for obsolete retorts, which stood in the December half of 1914 at £12,400, and in the present accounts at £7440; so that they had been able to pay off some of the suspense obligation in respect of the replacement of obsolete plant by modern plant. In the distribution items of the account, the repairs, maintenance, and renewals had been well kept up; and the expenditure in these directions had amounted to a considerable sum—over 10d. per 1000 cubic feet of gas sold. They were in the position of having uncompleted works; and although they tried very hard to avoid having extra labour and expenditure, they had to finish the jobs that were in hand at the time the war broke out, and which were not completed at the end of June last.

CAPITAL EXPENDITURE—MOTOR WAGGONS AND BARGES.

Some features of the accounts, he thought, would give the proprietors pleasure. In the capital account, there was one item for land, £2138. This land adjoined their Epsom works. The estate came into the market, the extent of the land being some 2½ acres; and it had upon it a convenient house, which would save the Company providing one for their manager there. For such an area, the amount of money expended, he thought the proprietors would agree, was extremely moderate, and that the purchase was a very proper one for the Board to have made, especially as it consolidated their works area and position at Epsom. It happened to be land scheduled in their Act of Parliament; and it was a curiosity of former legislation that they should have obtained power to make gas on land that did not belong to them. Parliament did such things years ago, but not now. On new buildings and plant, they had only spent £2098; but a large item was that for meters and stoves, £7368. Then there was a charge of £2200 for waggons and motors, and £6452 for barges. He might say here that one of the features of the Company's practice and economies, was the large amount of mechanical transport plant and barges which they now had. The proprietors knew that the Company were unique in having their own ships, which would pass right up the Thames from Newcastle. In connection with these ships, they had a fleet of large barges. These were bought thanks to the acuteness of their Engineer, who discovered there were some large barges for sale in Holland (where there was no use for them during the war); and he purchased them at a very reasonable price—at about half what they would have cost to build here. This, therefore, might be regarded as a very good investment. With regard to mechanical transport, they carried their coals direct from Wandsworth to both the Epsom and Mitcham works; and this was really the only way they could have economically kept the Mitcham works alive. When they were discussing their last Act of Parliament, it was quite on the cards that they would have to close the Mitcham works; but they had been saved by the transport of coal by waggon motors. With regard to the waggon motors and barges, he might mention that they were all met by a sinking-fund, and were not allowed to depreciate. The Directors were especially looking carefully at the question at the present time, to see whether or not they should set by a larger amount to the sinking-fund, so as to make it quite safe, seeing that motor waggons and barges were not quite such permanent matters as land and buildings. The Board had no reason to believe that these possessions stood in their books at above their value; as a matter of fact they believed they had improved in value, owing to the work that had been done upon them.

THE RESIDUAL PRODUCTS.

Concerning the residual products, with the exception of tar (upon which they were supposed to make a large profit, but did not), the income showed an improvement. The receipts amounted this year to £63,837, as compared with £46,600 in the corresponding half year. The improvement chiefly arose from coke, because the price of coal had gone up so considerably that the poor people were glad to buy coke at a higher price than before; and the industries in the Company's area which formerly used coal were now using coke. Tar gave them an income of £7150, against £7349. So that, though they had by the tar taken something out of the gas for making high explosives, this at any rate had not added anything to the receipts; and the Board did not think this was material, so long as they furnished the Government with what they required. Turning to the balance-sheet, sundry stocks and stores were down from £28,000 to £18,000, although coal and oil had risen from £11,000 to £29,000. This was very fortunate; but if they had not had their third ship, they would not have got in stock the quantity of coal they had done, which placed them in a position of safety.

PROFIT-SHARING, COUNTRY-SERVING EMPLOYEES, WAR BONUS.

He must for a moment return to the expenditure, to point out that profit-sharing called for £2100, against £2500. This was due to the price of gas having been increased, because, while this reduced the dividend, it also lessened the employees' bonus. But he was proud to say it still left a considerable amount for the men. In the comparative analysis which Mr. F. J. Bradfield, the Secretary of the Commercial Gas Company, published in the "Journal of Gas Lighting," the profit-sharing charge of this Company worked out to the very respectable item of ½d. per 1000 cubic feet, whereas in some of the companies that had raised the price of gas more than this Company had done, the charge was considerably less—not much more than half the amount mentioned. The allowances made by the Company to the dependants of their employees on active service amounted to £3482; and assistance in the way of extra food allowance owing to war prices, and a contribution towards the support of Belgian refugees, amounted together to

£4478. These three charges made £7961, which sum went a long way towards the amount now required for dividend. He thought the proprietors must be gratified to feel that the business of the Company was of a character that enabled them to so far supplement the income of those who were left behind by the brave fellows who had joined the Colours, as well as to help the employees generally during this time of dear provisions. He had nothing more to say, except to mention that the officers, their staffs, and the employees had been doing their duty in the most exemplary manner. They had been working short-handed in the clerical department, which was the reason that the accounts could not be got ready at the usual time, and that the meeting was being held a little later. It would be realized that every man in the Company's service was doing his "bit" towards carrying on the war. Although they did not all bear arms, they were making shells and the explosives for filling them. Their officers and men in the country's emergency had indeed put forward their best efforts.

The Deputy-Chairman (Mr. R. Garraway Rice) seconded the motion.

Major Lindsay-Davidson (King's Own) said, with regard to the question of freights, he was glad to find the Board had adopted such a far-seeing policy as to secure for the Company their own ships for the transport of coal to the works. It did seem to him to be a disgraceful thing that, while the Company and others were doing their best for the country in connection with the war, certain traders were taking advantage of it to attain their own ends. He hoped the Directors would put this matter before the proper authorities, and help in the movement to try to get a reduction of freights. He should like to know how many employees were serving with the Colours.

The Chairman said about one-third, or nearly 400. He agreed with the sentiments of the proprietor as to traders taking advantage of this dreadful emergency for making undue private profit. This not only applied to shipowners; there were other people connected with supplies who did not seem to be working quite so well as they might do in the country's interests. The Directors all shared with Major Lindsay-Davidson the heartiest contempt for these practices.

Major Lindsay-Davidson said he believed some of the companies were working together in the attempt to bring down the rates of freight.

The Chairman: That is so.

The motion was unanimously carried.

The Dividends and Re-Elections

The Chairman moved the declaration of dividends at the statutory rates per cent. per annum: On the Wandsworth "A" stock, £7 17s. 6d.; on the Wandsworth "B" stock, £6 7s. 6d.; on the Wandsworth "C" stock, £5 10s. 3d.; on the Wimbledon stock, £5 15s.; on the Epsom stock, £6 7s. 6d.; and on the new ordinary stock, £5 10s. 3d.

The Deputy-Chairman seconded the motion, which was unanimously carried.

Moved by the Chairman, and seconded by Mr. T. A. Ives Howell, the retiring Directors (Messrs. R. Garraway Rice, J. B. Howell, F. H. Jones, and B. R. Green) were re-elected.

Proposed by Mr. Hennell, and seconded by Mr. W. Richards, the retiring Auditor (Mr. E. L. Burton) was re-appointed.

Votes of Thanks.

The Chairman, in proposing a vote of thanks to the officers and employees, said he wished to supply an omission in his speech. It would be within the recollection of the proprietors that at a previous meeting there was some discussion as to the Company's investments and their depreciation. While he (the Chairman), as he told the proprietors, was at the time against making any change, there afterwards came the proposition of the Government to issue War Loan. As the Company were helping the Government in every way, the Directors thought they could not do better than take up some War Loan. A little was bought outside to qualify them for converting the 2½ per cent. Consols into 4½ per cent. War Loan in two particulars—the reserve fund and the special purposes fund. This cost them a loss on the face of the thing of £5702 in one case, and in the other of £1244. If the opportunity again offered, the Directors would not put the funds into these investments. They had plenty of room for funds of this kind in their own business, in which they could allow 5 per cent. interest without any depreciation; in future they would follow this line. But this was a proper occasion for taking up War Loan, and getting rid of the depreciated Consols. He proposed to have the figures conserved as to the losses sustained by this transaction; for it was just as well to let everybody at all times know how much the fall in public confidence cost the Company. This loss was not due to the Board; and if the proprietors wished to blame anybody they must walk across the road to the Houses of Parliament. He now asked them to pass a hearty vote of thanks to the Engineer and the Secretary, their staffs, the foremen superintendents, and the workmen.

Mr. T. R. Porter asked that, as they had all been working together under exceptionally difficult circumstances, the Chairman and Directors should be included in the same resolution. As the Chairman could not propose this, he would do so.

Mr. J. C. Potter seconded Mr. Porter's suggestion; and, in the amended form, the resolution was heartily agreed to.

The Chairman, in reply, said his colleagues and himself very much appreciated the approval of the proprietors; and they would continue to do their very best through these troublous times.

Mr. Braine also expressed, on behalf of his staff and himself, gratitude for the confidence the proprietors showed in them.

Mr. Carr, in his acknowledgment, said he could assure the proprietors that the staff and workmen worked well in the best interests of the Company in these very strenuous times. The employees would all be pleased to read the kind expressions of appreciation that had been made at the meeting.

In appreciation of the services of their Gas Manager (Mr. C. Parkinson), who has effected many improvements and reduced working expenses, the Dalton Gas Committee, at their last meeting, decided to increase his salary to £150 per annum, to date from Jan. 1 last.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

The Half-Yearly Ordinary General Meeting of the Company was held on Friday, at the Offices, No. 5, Great Winchester Street, E.C.—Mr. A. M. Paddon, the Chairman, presiding.

The Secretary (Mr. E. L. Burton) read the notice convening the meeting; and the report—*ante*, p. 497—and statement of accounts were taken as read.

The Speech of the Chairman.

The Chairman, in moving the adoption of the report and accounts, said the former document would have shown the proprietors that the Company had had a satisfactory extension of business at a time when very many undertakings were compelled to declare a decrease.

A REFERENCE TO MR. JOSEPH CASH.

Intimation was made in the report of the accession to the Board of Mr. Joseph Cash. He (the speaker) felt perfectly certain that all the proprietors would welcome Mr. Cash in the same cordial spirit that his colleagues on the Board had done. ["Hear, hear."] Mr. Cash's connection with the Company had existed for well over fifty years, and for thirty years he had acted as Chief Engineer and General Manager. It would be obvious that the value of his experience to the Board was considerable; and on this account alone, his presence as a Director was a distinct gain to the Company. They would all wish him the enjoyment of many years in the discharge of his new responsibilities.

THE ACCOUNTS.

Turning to the accounts, it would be noticed that they had powers with regard to the future issue of capital amounting to nearly £100,000 of ordinary stock, and some £32,000 of loan capital. The Board did not, however, contemplate availing themselves of either of the opportunities disclosed by these figures. In the aggregate, the capital raised—£703,378—represented £463 per million cubic feet of gas sold; and this was the lowest figure at which it had ever stood in the history of the Company. He had been able to make an announcement in these terms for a succession of half years; but he was afraid this was the last occasion for some little time to come upon which he would be able to congratulate the proprietors on the lowness of the capital, because they could not anticipate any further increase in the business, and the opportunity given to the Company by Parliament of revising the capital by buying and extinguishing their own stock must necessarily be brought to a standstill by existing circumstances. Capital expended during the half year amounted to £2840; and of this £2625 had been written-out by way of depreciation. So that they stood in much the same position with regard to capital, with the additional benefit of the extension of business noted in the report.

SALES AND WORKING RESULTS.

On the credit side of the revenue account, it would be seen that they had sold 735,123,000 cubic feet of gas, and this was an increase of 17,871,000 feet, equal, roughly speaking, to 2½ per cent. This increase did not represent adequately the extension of the Company's business which had occurred, because the consumption for public lighting had, owing to the closure put in force by the authorities, fallen off to the extent of 16,000,000 feet. Therefore they might say that in normal times of lighting their increase during the half year would have been more like 33,000,000 cubic feet. The reduction in the use of gas by the curtailment of public lighting would be understood when he told them that there were 2345 street-lamps less burning to-day than was the case a year ago. Meter-rents had brought in £5107, or £521 more. This might not be a big figure, but it was a significant one, because it was just the increase in meter-rental which indicated the genuine expansion of the business. The total rental for gas, meters, stoves, and fittings was £12,169 more. For residual products, they had obtained an increase of £4749 (over 20 per cent.), which was eminently satisfactory. The gas sold per ton of coal carbonized during the half year had been 13,168 cubic feet. The proprietors would recognize that this was an extraordinary figure. He had come across one or two isolated cases in which it was exceeded; but it was really an extraordinary figure, and it was one which would stand the closest possible scrutiny. The measurement of gas at Brighton, and the methods employed for ensuring absolute accuracy, were complete; and there was no possible qualification of the figure by any contemporary processes on the works. The unaccounted-for gas amounted to only 5·56 per cent. Of course, theirs was not a Metropolitan district. In many parts it was semi-rural, and in some altogether rural; and in these circumstances one looked for an increased ratio of unaccounted-for gas. Considering the extended area over which they had to distribute the gas, they would agree with him that the figure he had quoted reflected a great deal of credit on the executive.

EXPENDITURE ON REVENUE ACCOUNT.

On the debit side of the revenue account, coal, oil, and coke, added together, had cost nearly £6000 more, and wages £593 more. In their case, as in others, war bonuses entailed a special addition to the latter figure, and defeated all comparisons with pre-war periods of administration. He would call particular attention to the figures for repair and maintenance of works, mains, meters, and fittings. On the repair and maintenance of works they had spent an amount equal to 3·31d. per 1000 cubic feet of gas; on mains, &c., 2·81d.; on meters, just over 1d.; and on stoves and fittings, 3·77d. This was a total of just under 11d. per 1000 cubic feet, which was a fully adequate figure for a Company of their size. And when it was remembered that they had always kept their plant well maintained, and had always written what he might call the wasting assets down to the lowest possible figure, then the 11d. became even more important. It represented the continuation of a process that had been going on for many years. There was an item for insurance amounting to £878, which included protection against aircraft and bombardment—in fact, everything they could ensure themselves against. The figure for superannuation of officers was more; but it had to be taken in conjunction with the difference in the salaries that used to be paid to the older officers who had retired (and were receiving allowances), and those paid to their successors who had shorter periods of service to their credit. Allowances to dependants of employees serving with the forces came to £1386, or an increase of £293. But this no one would begrudge.

EMPLOYEES AND THE WAR.

In the matter of these allowances, the Board had tried to treat the employees liberally. They had endeavoured to make the task of the Government as easy as, in their small compass of opportunity, they could; and a very large percentage of the employees were serving their country in this crisis. He did not think the Company had sought to avail themselves of the exemptions which one heard so much about. It seemed to him that the gas industry in very many instances had availed itself to an unjustifiable extent of the opportunity for holding back men from the forces. In their own case, they had had to have recourse to female labour; and experience had shown them that very much of the work that had to be done could be performed exceedingly well by women. Gas companies should do all they could by replacement in this way before advocating the wholesale wearing of badges, and asking the Government to assist them in keeping the business going. The profit and loss account disclosed the important fact that, whereas there was brought in £36,613, there was taken over £41,200, after having satisfied every possible demand. To the benefit fund there had been transferred from revenue account £883, while the requirements of the fund had only called for the disbursement of £583. The balance carried forward on account of this fund was £2685, which seemed much larger than the immediate needs would justify; but looking ahead, when the war came to an end there might be a great deal for them to do out of the fund for those who had returned from making their great measure of sacrifice for the country. If, therefore, it was possible to accrete money at the present time, the Directors felt they ought to do it. From the balance-sheet, it would be noticed that the investments of the reserve, special purposes, and benefit funds figured at £75,999, and that their estimated value at Dec. 31 was £75,710. By their last Act of Parliament, they were able to apply the reserve fund to the authorized dividend; whereas before they could only apply it to the standard dividend. This was a distinct gain from the proprietors' point of view. In a sliding-scale gas company, the reserve fund was, correctly speaking, the property of the proprietors; and therefore its availability to them should be as complete as it was possible to make it by Statute, which was the case here.

THE COAL PROBLEM.

As to the future, he did not expect the next accounts would be as favourable as the present ones. There was not an adverse circumstance or condition that would not be accentuated during the current six months. They would have to deal with dearer materials all round; but, as ever, coal would be the chief difficulty. The Company had been most loyally and efficiently served by their Contractors, Messrs. Stephenson Clarke and Co. Through all this trying period, they had been most devoted and most assiduous. They had spared the Company every possible evil consequence that could be avoided, by their tact and their knowledge, which was almost unexampled. They had assisted the Directors in every way, and had lightened the burden so far as they could do so. But they were not coal proprietors in their relations with the Company, and behind them lay the great difficulty—the difficulty which oppressed the whole country to-day. Contrast for a moment the responsibility of a gas undertaking as compared with that attaching to the supply of coal. To-day gas undertakings did not stand in a class apart. They were like electric and water undertakings and the great transport enterprises. All were strictly limited and regulated by Government enactments; they worked within a narrow circle of Government restriction and supervision. This was because they were supplying what was tantamount to a public necessity. But in the case of all these four branches of industrial activity, the supply of coal was all-important. The Prime Minister had said that the supply of coal was the life-blood of the nation; but he seemed to have left the subject severely alone after this comment. It was the life-blood of the nation; and it was utterly unregulated. This state of affairs it seemed to him could be altered. Speaking with a not inconsiderable experience of private and public legislation—that was the method by which the regulated industries he had referred to had been given their charter—he did not think there would be any serious practical difficulty in bringing the coal supply of the country under statutory limitations. From a practical point of view, it would be possible; but politically, of course, he could not pretend to say.

The Deputy-Chairman (Mr. G. W. Carey) seconded the resolution.

Mr. W. A. Hounsom said they knew the unique experience of Mr. Cash, and hoped his services would be at the disposal of the Board for very many years to come. At the same time he was glad to see that, by Mr. Rutter's appointment to the position Mr. Cash had vacated, the link which was broken when Mr. Rutter's grandfather passed away had been re-forged. He hoped he might have a long and useful life in connection with the Company. As to coal, the railway companies were learning something of what could be done by co-operation; and it might be that after this terrible crisis they would all carry on their business in a wiser manner—by co-partnership, co-operation, and fusion of interests.

Mr. S. Spencer, after remarking on the excellent working revealed by the Chairman's speech, said fifty years ago one used to get coal at about 5s. per ton, for which it was now necessary to pay 26s.

The Chairman, after replying to a number of questions, said the Board certainly anticipated from Mr. Rutter services something of the kind which his grandfather rendered to the Company many years ago. They appointed Mr. Rutter because they believed him the best man for the work.

The resolution was then unanimously carried.

Concluding Business.

On the motion of the Chairman, seconded by Mr. A. F. Phillips, dividends were declared (less income-tax) for the half year at the rates per annum of 6 per cent. on the "B" preference stock, 4 per cent. on the "C" preference stock, 10¾ per cent. on the original ordinary stock, and 7¾ per cent. on the "A" ordinary consolidated stock.

Proposed by the Chairman, and seconded by Mr. Phillips, Mr. Carey was re-elected a Director; and, on the motion of Mr. Spencer, Mr. William Cash was re-appointed as Auditor. On the proposition of Mr. F. E. Pilley, Mr. Cash was also appointed Special Auditor, in conjunction with the Special Auditor appointed by the Corporation of Brighton.

The Chairman proposed, Mr. Spencer seconded, and the meeting cordially passed, a vote of thanks to the officers for their services during the past half year.

Mr. Burton and Mr. Rutter responded. Mr. Rutter mentioned that the number of men serving with the colours (out of 800) was 359. Three had been killed, five wounded, and one was missing. The proportion who had joined was 45 per cent., which was a figure to be proud of. It was rather over eighty years since his grandfather was appointed Engineer to the old Company; and from that time to this there had always been a Rutter connected with the Brighton Company, except for five years when he (the speaker) was with the North Middlesex Gas Company. It would be his endeavour to emulate his grandfather in the care and attention which he gave to the business of the Company.

The meeting closed with a hearty vote of thanks to the Chairman and Directors, on the proposition of Mr. G. Crispe Whiteley.

NORTH MIDDLESEX GAS COMPANY.

A Golden Opportunity for Gas Companies.

The Half-Yearly Meeting of the Company was held on Monday of last week, at the Offices, No. 5, Great Winchester Street, E.C.—Mr. A. M. Paddon, the Chairman, presiding.

The Secretary (Mr. Ernest L. Burton, F.S.A.A.) read the notice convening the meeting; and the report of the Directors and the statement of accounts were taken as read.

The Chairman's Speech.

The Chairman said the leading matters of interest were, shortly, that, in times of exceptional difficulty, the Company had succeeded in maintaining, and even slightly extending, the volume of their business, and also in paying the same dividend that obtained in the happier days before there was a war. Running briefly through the accounts, it would, in the first place, be seen that they had still a considerable amount of capital to issue, when it might be desirable to do so; but as matters now stood, of course, this was not a policy which a company would readily adopt. These were days in which it was necessary to restrain their activities as much as possible, and refrain from making demands on the public which they knew would not be met in the satisfactory way they formerly were.

THE CAPITAL ACCOUNT.

Consistently with this policy of economy, it would be observed that in the six months ended Dec. 31 the Company had only expended £466 on capital account; and they had eliminated £325 of this by depreciation. So that, while there had been some increase in the business, the capital had remained *in statu quo*. The total capital received for the purposes of the undertaking amounted to £689 per million cubic feet of gas sold. This was a much higher figure than had obtained in recent years; and the Directors were sorry that it was higher. But, nevertheless, one could not consider a figure like this by itself. It had to be taken in connection with the assets of the Company, with the value of the works, and with the efficiency of the works. The assets had been very considerably enlarged within recent years. The Company possessed a great deal of land for an undertaking of this size; and the land must go on increasing in value—which could not be said of all other kinds of assets. In the next place, they had just completed the renovation and the reconstruction of their works, bringing them up to the most approved form in existence. The balance of capital in hand was shown as £32,236; but this was qualified by the statement in the balance-sheet which showed that of it they required some £19,450 for the purposes of the prepayment installations. This was kept as a floating sum, which varied from half year to half year. He might say that, although the business was larger than six months ago, yet the amount of capital utilized in this all-important department had decreased by £1600. This showed that they kept this particular form of plant, which really were implements, written-down to the lowest possible figure; so that the position in this regard improved steadily from half year to half year.

LAST HALF-YEAR'S BUSINESS.

Looking at the revenue account, coal, oil, and coke had cost £2374 more. This was not a very great deal; and it would indicate to the proprietors that the Company had not as yet met the full impact of the increase in prices which obtained at the present day. Some remnants of the cheaper contracts had come forward for use during the past six months; and it would therefore be in the future rather than in these accounts that they would have to look for the figures which would represent the tremendous increase in the cost of materials which they all knew existed. On repair, maintenance, and renewal of works and plant, there had been spent over 4½d. per 1000 cubic feet of gas. This item and the similar allocations for mains and service pipes, meters, and stoves and fittings, were of crucial importance in a revenue account, because they represented the sums devoted to maintaining and improving the plant, and keeping it in proper order as a profit-earning machine. These four items stood at a more ample figure than they had hitherto reached in the history of the Company. It was a policy which he ventured to think was absolutely the correct one at times like these, that they should not allow themselves to come within measurable distance of estimating the profit until everything had been done that could be done in order to maintain the whole of the works, &c., at the highest possible point of profit-earning power. The Company were insured against damage by air-craft. Some eighteen months ago, there might have been uncertainty as to the expediency of this; but he thought by now they had all been educated past this point, and that it would not be wise of any gas company in this quarter to neglect to make due provision for contingencies of this kind. Bad debts were only £52 more; and the figure this item stood at was largely due to the fact that they were making in these accounts ample provision for anything that might come upon them by reason of worse times ahead. Up to the present, the collection had not been more difficult than hitherto; but though they had passed through some evil days, there were worse to come, and it was wise to take precautions. There was an allowance of nearly £500 for dependants of employees serving with the forces. This was an increase of £240 over a year ago; but he was quite sure the proprietors would be in full sympathy with any allocation of this kind, to assist the brave men who in the early stages of the war went forth to do their duty. On the credit side of the revenue account, they had sold 3,432,000 cubic feet more gas, which represented an increase of roughly 2¼ per cent. Gas, meter, stove, and fittings rental brought in just over £2000 additional—charging 3s. 4d. per 1000 cubic feet, as against 3s. 2d.

CONCEPTIONS OF DUTY.

While they had only increased their charge 5 or 6 per cent., they had to meet an increased price of coal of from 35 to 40 per cent.; and almost every other commodity was being pushed up in a similar way. If gas companies had not a better conception of their duty to the public than had sellers of coal and owners of ships, the public would be in a very bad way indeed. Of course, gas undertakings were not philanthropists. The state of things they were dealing with that day would not, he hoped, be a permanent one; and he ventured to think the consideration which gas companies were now showing for the difficulties of their consumers would bring them in a very useful return in the future. After all, they had to remember that their commercial competition now was more with coal as a fuel than it was with electricity as a light. Gas was so much the cheaper as an illuminant that variations in price would not make much difference. Their real contest was in getting people to understand that gas was more convenient and economical than coal for heating purposes. This was a golden opportunity for them to show it; and by increasing the price of gas to the small extent they had done, they ought to establish a preferential position in the public esteem and regard which would do very much to advance their business in the future. For residuals they had received about £1560 more.

FUTURE PROSPECTS.

The total receipts were £3574 more, and the expenditure £4479 more. The profit amounted to £5617, which was £904 less than was the case a year ago. After paying the dividends for the previous half year, there was left £3967; and adding to this the present profit and interest, gave £9602. There would, after interest and income-tax charges had been paid, be a sum of £8548; and when the present dividends were paid, there would remain an amount of £3174 to carry forward, or £793 less than was brought into the account. But when they considered the maintenance items in the revenue account to which he had already referred, they would see that this reduction was fully accounted for. This maintenance charge altogether was no less than 1s. 3½d. per 1000 cubic feet of gas, which they would agree was a very healthy condition of affairs. As to the future, there was not the slightest doubt that the difficulties before them were far greater than those that had already been surmounted. The cost of coal was going to be very considerably increased over what it was now; and they could not expect to derive from residuals very much more than they were doing to meet the increase. In fact, in certain directions they must look for a diminution in the receipts from residuals. It could hardly be expected that tar would give them as much as it had done in the past; while coke could give them very little more. They had worked up the efficiency of their plant, as he had said, to the highest possible point. But they ought never to be at the end of their resources with regard to economy; and he thought they had succeeded in the past in showing what could be done by assiduous endeavour, and by the technical knowledge so amply represented on the Board. He trusted they would be able to deal with matters as they arose. Though the proprietors must not expect that in existing circumstances the present state of prosperity could be indefinitely maintained, yet he thought for some half years to come the Directors would be able to look after them with respect to dividend. After this terrible cloud had passed, they would no doubt reassert themselves, as in the old days, as a first-class profit-earning undertaking. He concluded by moving the adoption of the report and accounts.

Mr. H. A. Lermitte seconded the resolution, which was carried unanimously.

On the proposition of the Chairman, seconded by Mr. A. F. Phillips, dividends for the half year were declared, less income-tax, on the preference capital at the rate of 5 per cent. per annum, on the original ordinary capital at the rate of 11 per cent. per annum, and on the additional ordinary capital at the rate of £7 14s. per cent. per annum.

The re-election of Mr. Paddon as a Director was agreed to, on the motion of Mr. Lermitte, seconded by Mr. S. A. Sampson; and the Auditor (Mr. L. Hardy) was also re-appointed, on the proposition of Mr. C. H. Rutter, seconded by Mr. William Richards.

The Chairman proposed a hearty vote of thanks to the officers for their very successful efforts on behalf of the Company during the past six months.

Mr. F. J. Bancroft, in seconding, remarked that, as an officer of a neighbouring Company, he could personally testify to the excellent manner in which the work of the North Middlesex Company was carried out.

The vote was cordially passed, and acknowledged by Mr. Lawrie Trewby (the Engineer) and Mr. Burton.

A similar vote of thanks to the Chairman and Directors concluded the proceedings.

The annual financial statement submitted to the Belfast Corporation shows grants from the Gas Department for £11,400 for payment of interest and sinking fund on the cost of the new City Hall, and £5000 for the relief of rates. The Electricity Department made a grant of £5000.

BARNET DISTRICT GAS AND WATER COMPANY.

An Anxious Outlook Regarding Coal.

The Half-Yearly Meeting of the Company was held on Monday of last week, at the Offices, No. 139, Cannon Street, E.C.—Mr. A. F. Phillips, the Chairman, presiding.

The Secretary (Mr. Ernest W. Drew, F.C.A) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

The Chairman, on rising, expressed regret at the unavoidable absence of the Deputy-Chairman (Dr. J. W. L. Glaisher) and of Mr. Samuel Cutler. Proceeding to move the adoption of the report and accounts, he said that in the six months ended Dec. 31 there had been no addition to the gas capital, and the only addition to the water capital was £163 for new mains. The result of the half-year's gas business was much the same as in the corresponding half of 1914. The sale of gas was only 750,000 cubic feet, or 0·77 per cent., more. What was gained from new private consumers was lost by the suppression of the public lamps and restricted shop lighting. Coal cost £7495, against £6508; and the increase in the quantity carbonized was 106 tons. As was mentioned in the report, the Company benefited to a considerable extent by contracts made before the war, so that the average increase in the cost was about 2s. 7d. per ton. During the current half year, revenue would have to bear the full cost of the increased price. Repairs and maintenance came out at £3229, as compared with £1386. This increase was due to part cost of replacing the present system of removing the coke from the retort-house with improved coke-conveyors. The charge for stoves and fittings was £1215, against £1535. The number of new consumers was less—probably to some extent due to so many fitters having enlisted. The reduction in the cost of the public lamps from £712 in 1914 to £259 on the present occasion was owing to the discontinuance of the public lighting. There was a new charge in the accounts—the war bonus allowance made to the staff and employees now serving with the forces. The sale of gas for private lighting realized £16,094, against £14,938; the increase being chiefly due to the extra 2d. per 1000 cubic feet of gas, which was charged from Lady-day last. Residual products realized £4475, against £3689; coke and sulphate of ammonia showing improvements, but tar a considerable falling-off. The other receipts and expenses corresponded with those of the previous year. The figures were given on the accounts; and it was consequently unnecessary for him to dea with them. The balance carried to profit and loss was £4593, as compared with £4745 in 1914. In the water revenue account, receipts and expenses being much the same, he need not call attention to them. As in the case of gas, there was a new charge of £244 for war allowances. The water delivered into the district was 400 million gallons, or 12 million gallons less than in the previous year. The pumping charges were only £155 more, which was satisfactory, considering the increased cost of fuel. It showed that the pumping plant had been maintained in an efficient condition. The domestic supply of water had been well looked after—the consumption amounting to only 19·15 gallons per head per day. The net water-rental showed a decrease of £223, due to less water being supplied for trade purposes, and the absence of building in the district. The balance carried to profit and loss was £14,636, against £14,978 the previous year. It would be seen from the profit and loss account that, after providing income-tax £2960, interest on debentures £1651, and carrying £2000 to the contingency fund, the balance available was £36,165, of which the proposed dividend would absorb £12,423, leaving £23,742 to carry forward. Throughout the half year it had required considerable exertion to obtain supplies of coal; and the future was full of anxiety, both as to supplies and price. The works had been carried on with difficulty, owing to the loss of many employees and members of the staff who had joined the army. Those remaining had, however, proved most loyal to the Company and attentive to their duties, fully maintaining the supply of gas and water.

Mr. Alfred Lass formally seconded the resolution.

Mr. C. P. Crookenden having remarked upon the excellent figure of 19·15 gallons of water per head,

The motion was unanimously carried.

Proposed by the Chairman, and seconded by Mr. J. E. Plummer, dividends were declared, less income-tax, for the half year, at the rate per annum of 9 per cent. on the "A" and "C" stocks, 8 per cent. on the "B" stock, and £6 6s. per cent. on the "D" capital gas and water stocks.

The retiring Directors (Dr. Glaisher and Mr. Plummer) were then re-elected, on the motion of the Chairman, seconded by Mr. J. L. Chapman; the retiring Auditor (Mr. B. Dennett Holroyd), on the proposition of Mr. William Richards, seconded by Mr. F. R. Smith.

The Chairman, in proposing a vote of thanks to the staff for their services during the past half year, remarked that they had worked exceedingly well, and been most loyal to the interests of the proprietors. The Engineer (Mr. F. J. Bancroft) had maintained the property in a very efficient state—which was proved by the fact that the sale of gas for the past six months was 13,200 cubic feet per ton of coal carbonized, and, as he had already stated, the water department was so well looked after that the supply was only 19·15 gallons per head per day. To Mr. Drew, also, they were much indebted. Other members of the staff had served the Company equally well; and he desired to include them all in the vote.

Mr. Crookenden seconded the proposal, which was heartily agreed to, and acknowledged by Mr. Bancroft and Mr. Drew.

On the proposition of Mr. Smith, a cordial vote of thanks was passed to the Chairman and Directors.

The Chairman, in response, said that, considering the great addition to the cost of coal, the increase of 2d. per 1000 cubic feet to the price of gas was very reasonable. The Board trusted they would be able to maintain the undertaking in a satisfactory condition without making any further advance. He was, however, afraid there were still a vast number of people who did not realize the position in which they were placed, and how much the rise in prices of material had affected undertakings of this sort.

COLCHESTER GAS BILL.

An Agreement come to with Lexden.

Last Wednesday, at the meeting of the Lexden and Winstree Rural District Council, the Special Committee appointed to consider the provisions of the Colchester Gas Bill reported that they had had two interviews with the Solicitors and the Manager of the Company. They were unable on the first occasion to come to terms with the promoters, and accordingly gave instructions for a draft petition against the Bill to be prepared. The promoters' representative, however, asked for a second interview; and, as the result, the Committee had agreed to the following terms, which will be inserted in the clause in the Bill for the protection of the Council:

(1) Limiting the time for which the Company will have power, if they have not laid mains, in the parishes affected, for a period of five years after the war, at the expiration of which period they will not be entitled to lay their mains in any of the parishes after twelve months' notice from the Council requiring them to do so, and providing that the authorized undertakers may supply in such of the parishes as may be supplied by the Company after the period mentioned.

(2) Giving the Council the same protection in regard to the roads and bridges as will be afforded to the County Council.

(3) Limiting the price of gas in that part of the parish of Stanway which is situate within a distance of a hundred yards on either side of the London Road to the same price as that charged in Colchester.

(4) Limiting the price of gas in the parish of East Donyland to a price not exceeding 6d. more than charged in Colchester.

(5) Limiting the price of gas in the remainder of the parishes to not more than 9d. in excess of the price in Colchester.

The Committee's recommendation was adopted, that their action be approved and adopted, and that they be authorized to settle the draft clauses which have been submitted by the promoters.

LIGHTING OF FACTORIES AND WORKSHOPS.

The L.C.C. and the Departmental Committee's Report.

At to-day's meeting of the London County Council, a report of the Public Health Committee will be presented, dealing with the recently issued Departmental Committee's Report on Lighting in Factories and Workshops.

The Committee merely point out that the inquiry has practically been limited to the engineering, textile, and clothing trades. The evidence adduced shows that in modern factories good lighting is now regarded as one of the most important factors contributing to industrial efficiency, and that while there has been a great advance in methods of illumination, there is considerable need for general improvement, particularly in the case of old factories.

The Departmental Committee, it is mentioned, call attention to existing requirements which are alleged to have led to some difficulty in regard to the admission of adequate daylight to factory premises; and then point out that the Committee appear to be satisfied that inadequate lighting is a contributory cause of accidents, and the impression is conveyed that unsatisfactory lighting is prejudicial to health in various ways. It is also recognized that insufficient light adds to the difficulty of maintaining the premises in a clean and sanitary condition. Statutory powers are recommended (*a*) requiring adequate and suitable lighting in every part of the factory or workshop, and (*b*) giving power to the Secretary of State to make orders defining adequate and suitable illumination. The expression adequate lighting is explained as meaning, in workrooms, a minimum provision at the floor-level of the working parts of 0·25 foot-candle, in foundries, 0·4, and in the lighting of approaches, 0·1 foot-candle, with yard lighting equal to 0·05 foot-candle. No recommendation is made at this stage as to the special illumination required for executing the work. Suitable lighting is defined as the avoidance of glare and extraneous shadows and the obtaining of a reasonable degree of constancy and uniformity of illumination. The recommendations apply to both natural and artificial lighting. The Departmental Committee are awaiting more settled economic conditions before further prosecuting the inquiry; and the Health Committee state that—"There does not appear to be anything in the report which calls for action by the Council at the present time."

Felixstowe Gas Company.—The report adopted at the annual meeting of the Company stated that, while the gross revenue was higher than in the previous year, this had been secured at a very much greater cost for coal, labour, and materials of all descriptions. Dividends were agreed to making a total distribution for the year of 8 and £5 12s. per cent. respectively on the "A" and "B" stocks. In order to do this, it will be necessary to withdraw from the profit and loss credit balance a sum of about £200, which was a trifle more than was added to it at the end of 1914. The Chairman (Mr. E. Woodmancy) remarked that the actual sale of gas was about equal to that of the preceding twelve months. More was sold in the first half, however, at the 1914 price, and less in the second half, when the charge was 3d. per 1000 cubic feet more. The net cost of the gas sold in 1915 was 3d. per 1000 cubic feet more than in 1914; and seeing that they only got 3d. increase, and this on a considerably less output, it was obvious that they could not expect to show anything like the profit they usually had. It seemed a little strange that, when the Minister of Munitions had been recommending that everybody should use as much gas and coke as possible so as to enable gas companies to supply necessary materials for explosives, the War Office, when they had the chance of having gas in all their hutments, did not take it. If they had, it would have helped the Company, who would have been able to supply more coke at a less price than the War Office now had to pay in purchasing at a distance. The Government gave other people advice, but did not carry it out themselves.

EDINBURGH AND LEITH GAS COMMISSIONERS.

Works to be Placed under Government Control.

At the Monthly Meeting of the Edinburgh and Leith Gas Commissioners on Monday of last week, it was reported that the Stirling boiler attendants at the gas-works, not being satisfied with the Commissioners' decision in connection with the application for an increase of wages [*ante*, p. 321], had, on the 4th ult., threatened to leave work unless they received an advance of ¾d. an hour in addition to the war bonuses. The matter was brought under the notice of the Lord Provost of Edinburgh; and he expressed the opinion that, inasmuch as the Government had expended a good deal of money in erecting plant at the works for the production of chemicals for high explosives, the Munition Authorities in London should be informed of the attitude of the boiler attendants. He advised that the Conveners of the Works and Finance Committees, along with the Engineer (Mr. Alexander Masterton) and the Clerk (Mr. J. M'G. Jack), should place the facts before the Munitions Department. This advice was carried out on the 8th ult. The deputation was received by Mr. Garrod, who informed them that an order was to be issued within a few days which would bring under the Munitions of War Act, 1915, and the Amendment Act, 1916, those gas undertakings that were assisting the Government in the manufacture of toluol, benzol, &c., required for the production of ammunition. Since the interview, Mr. Garrod had forwarded to the Commissioners certain regulations, the effect of which will be to bring their undertaking under control so far as the works and manufacture are concerned, but not as regards the financial side. Under these regulations, questions as to rates of pay and conditions of employment, failing agreement, will require to be settled by arbitration. The men had been informed that, if they withdrew their notice to cease work, the Commissioners would be prepared to concur with them in referring to an arbitrator, to be appointed by the Board of Trade, what rise of wages (if any) should be granted. The men had agreed to this proposal; and Sheriff Louttit Laing, of Aberdeen, had been appointed to adjudicate upon the question.

The Commissioners also had before them a request by the National Union of Corporation Workers that the additional war bonus recently granted to the permanent employees should be extended to temporary men; but, on the recommendation of the Works Committee, they decided not to comply with it. An application from the Edinburgh and Leith Master Plumbers' Association for an advance of 15 per cent. (to meet the enhanced wages of their employees) on schedule prices for fixing gas-fires, &c., was acceded to—the increase to take effect from Whitsunday next.

At a subsequent stage of the proceedings, it was announced that the following increases of war bonuses had been agreed to by the Commissioners:

(1) To all workmen whose wages or average wages at present amount to 20s. and up to and including 30s. per week (exclusive of war bonus and value of other concessions), an additional bonus of 2s. per week—making a total bonus of 4s. 6d. per week.

(2) To all workmen whose wages or average wages at present amount to 30s. and up to and including 35s. per week (exclusive of war bonus and value of other concessions), an additional bonus of 1s. 6d. per week—making a total bonus of 3s. 6d. per week.

(3) To all workmen whose wages or average wages at present amount to 35s. and up to and including 40s. per week (exclusive of war bonus and value of other concessions), an additional bonus of 1s. per week—making a total bonus of 3s. per week.

The foregoing enhanced war bonus is not to apply to the tradesmen enumerated below, who are at present receiving the recognized trade rates or their equivalents; nor is it to be applicable to any of the temporary or casual hands throughout the works or distribution departments: Bricklayers, joiners, turners, fitters, painters, masons, blacksmiths, brassfinishers, and plasterers.

The bonuses come into operation as from Nov. 15, 1915, and are not to affect any of the employees serving with the Imperial Forces. The total annual charge represented by the proposals will, it was stated, amount to £1580.

Castleford and Whitwood Gas Company.—The annual meeting of the Company was held on Monday of last week, under the presidency of Mr. Thomas Gill, J.P. In moving the adoption of the report and balance-sheet, the Chairman stated that the result of the year's trading showed a decreased revenue of £1059, and an increased expenditure of £982. The sum available for dividend (including the balance from the previous year, and after payment of the interim dividend in the first half year) amounted to £4924. Dividends at the rate of 11 per cent. on the original stock and 8 per cent. on the additional stock were declared, leaving a balance of £3214 to carry forward. During the year, Mr. Alfred Wilson, who had been the Secretary of the Company for 37 years, was elected a Director, and his son, Mr. H. L. Wilson, was appointed Secretary.

Issue of Capital Authorized at Watford.—At an extraordinary meeting, the Directors of the Watford Gas Company have been authorized to raise additional capital not exceeding £50,000, in such times and on such terms as they shall decide. This followed the ordinary half-yearly meeting, at which the Directors reported a decrease in the sale of gas, though, taking into consideration the reduction in lighting, the result was far from being unsatisfactory. The demand for gas fires and stoves was still increasing. There was an available balance on profit and loss account of £8548; and the full statutory dividends were declared. The Chairman (Mr. E. J. Slinn) pointed out that the co-partnership sum showed a reduction of nearly £70, which was a reminder that the forced increase in the price of gas hit the co-partner as hard as it did the shareholder, and very much harder than it did the consumer. They finished the half year with a good balance at the bank, and substantial stocks of all requirements, which would give a good start to the current half year, and so partially meet the ever-increasing prices of materials. Since the beginning of the war, 48 of the regular staff had enlisted, and eight of their casual employees.

THE ROAD BOARD AND TAR PRODUCTS.

Circular to County Authorities.

The following is the text of the circular which, as stated in the "JOURNAL" last week, has been issued by the Road Board to county authorities; it is dated the 25th ult.

I am directed by the Road Board to inform you that they have been in communication with the Treasury as to the policy to be observed by the Road Board in regard to applications for advances towards the cost of road-crust improvements to be carried out during the financial year 1916-17; and it has been agreed that new grants or loans, to an aggregate sum not exceeding £200,000, may be made out of the surplus at the credit of the Road Improvement Fund.

The grants and loans will be confined mainly to expenditure on tar treatment of important roads, either in the shape of surface dressing or pitch grouting or tar macadam. It has been brought to the notice of the Board by the Ministry of Munitions that certain products obtained from the distillation of crude tar are of great importance in connection with the supply of high explosives, and on this account it is desirable to encourage the use of refined tar by highway authorities. Apart from this, however, the Board consider that at the present time, when it is desirable to economize expenditure as much as possible consistently with adequate maintenance, a surface dressing of tar is generally the most effective and the cheapest method of preventing disintegration and thereby prolonging the effective life of a road crust, provided that the surface is in sufficiently good condition to justify the application of the tar dressing. The Board will require to be satisfied on the last-mentioned point in the case of each application for a grant. No grant will be made for the use of crude tar.

Applications for grants or loans should be sent forward at an early date, and should be accompanied by: (1) Particulars relating to the proposed improvement prepared in accordance with the enclosed memorandum and forms; (2) a summary of the highway estimates of the Council for 1916-17; (3) a statement on form attached showing the total expenditure on roads and bridges in 1914-15 and 1916-17 (estimated) in continuation of the information supplied to the Board on Yellow Form 42 "Information relating to the expenditure by county councils on road and bridges."

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FARMERS AND THE USE OF SULPHATE OF AMMONIA.

The Government Price Objected to.

At a meeting last Wednesday of the West Riding of York War Agricultural Committee, held at Wakefield, a communication was received from the Ardsley District Sub-Committee as to the high price of sulphate of ammonia.

Alderman the Rev. L. B. Morris remarked that farmers were disposed to use sulphate, but the price was prohibitive.

The Chairman (Major J. W. Dent) observed that £16 10s. a ton was the price at which manufacturers were prepared to sell; and the Government had for the present stopped the export of sulphate, with a view to putting stocks at the disposal of farmers. The farmers naturally supposed that when the export was prohibited prices would fall materially; but they had not done so. Certain farmers' associations took the view that the Government should fix the price; but in a speech which he delivered to the Farmers' Union, Mr. Acland said farmers should be chary about asking for the price to be fixed, because if they had prices fixed for what they wanted to buy, they might find prices fixed for produce they wanted to sell. Makers of sulphate were already saying they could not hold their stocks any longer; and if they could not dispose of them they would have to shut-down production. It seemed, therefore, the only thing for farmers was to send in their orders, as there would be no official fixing of the price, and makers were strong enough to stand out against any reduction.

Mr. R. Garnett said it seemed that makers were taking advantage of the recommendation of the Board of Agriculture to farmers to use sulphate of ammonia. The farmers had to consider whether, at 16s. 6d. per cwt., it was a good commercial proposition from their point of view; and they were of opinion it was not. All the advice of Lord Selborne and the Government was not likely to be accepted by the farming community unless a lower price was fixed.

The Chairman thought that sulphate was worth trying, if used with care and discretion—even at £16 10s. a ton, having regard to the present prices of agricultural products.

No resolution was passed.

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Belfast Water Undertaking.—Mr. F. W. M'Cullough, J.P., the Engineer of the Belfast Water Commissioners, delivered an address before the local Rotary Club, on "The Development of the Belfast Water Supply." He traced the history of the supply from 1613, when the place obtained a Charter from James I., down to powers being granted to the Commissioners' Board in 1840, and the extensions to Woodburn and Lough Mourne areas and further powers granted in later years. When all sections of the Mourne scheme were completed and developed, there would be, Mr. M'Cullough said, a total supply of about 33 million gallons per day for use in the city alone. The quantity would be more than double the daily amount now available from both the Woodburn and Stoneyford sources of supply. The Commissioners had already decided to proceed with the construction of the works included in the second section of the Mourne scheme, and the contract, plans, and specifications were now in hand for the proposed storage reservoir in the Kilkeel Valley, which would have a capacity of 3000 million gallons—in itself storing more water than all the fifteen reservoirs in the Woodburn and Stoneyford systems, and forming one of the largest storage reservoirs of an artificial character in the United Kingdom.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *March* 6.

There is little of interest to report in the London tar products market. Both in London and in the country increased attention is being paid to the question of the use of pitch for gas making, and it is quite expected that material quantities will be absorbed in this manner. Makers still quote pitch at 19s. to 19s. 6d. per ton f.o.b. works; but there is a reluctance to make offers for forward delivery. Creosote is in demand at 4d. to 4⅛d. net in bulk; while 90-160 solvent naphtha remains at 2s. 2d. to 2s. 3d. net and naked per gallon, in bulk at makers' works.

Sulphate of ammonia remains inactive pending the issue of export licences, and prices are nominally as last named.

Tar Products in the Provinces.

March 6.

There is no alteration in the markets for tar products. Pitch remains in the same position. No business of importance is reported in creosote. Solvent and heavy naphthas are in good demand; but some business is reported in light solvent at slightly lower prices.

The average values of gas-works products during the past week were: Gas-works coal tar, 16s. 9d. to 20s. 9d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. to 2s. 1d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2½d. to 2⅝d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Manchester Tar Prices.

The average price realized for tar—based on the value of the products—for January deliveries, in the Manchester district, was 23s. 9d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Mar.* 4.

There has again been a moderate amount of business doing, but the limitation of exports by the War Trade Department has precluded any great demand and any recovery in values. Consequently the quotations remain £16 17s. 6d. per ton f.o.b. Hull, £17 per ton f.o.b. Liverpool, and £17 5s. per ton f.o.b. Leith. Unfavourable weather has discouraged buying for home consumption, and no large amount of business in this department has transpired. Producers still maintain a conservative attitude in regard to the forward position; but there have been second-hand dealings at a premium of about 5s. per ton on prompt prices.

Nitrate of Soda.

This article remains very firm at 16s. 10½d. per cwt. for ordinary quality. For refined, the price has been advanced to 17s. 9d. per cwt.

Sulphate of Ammonia.

From another source it is reported that prices are slightly lower. Outside London makes are quoted at £16 to £16 2s. 6d.; Hull, £16 15s.; Liverpool, £16 17s. 6d. to £17; Leith, £17; Middlesbrough, £16 17s. 6d.

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COAL TRADE REPORT.

Northern Coal Trade.

There is some irregularity in the demand for coal—owing to the varying supply of tonnage, and the stormy weather which has prevailed, with the delay of steamers. In the steam coal trade, there is a fair amount of fuel offering, and some buyers seem to expect lower prices. For best Northumbrian steams, the quotation is from 32s 6d. to 34s. 6d. per ton f.o.b., according to the time of delivery; second-class steams are from 28s. 6d. to 29s. 6d. per ton; and steam smalls are from 15s. 6d. to 17s. per ton—the latter kind being in rather better demand. Shipments are fair in the circumstances, for the delay of tonnage is affecting unequally the collieries. But output also varies; so that the price is a little more a matter of bargaining between the figures named. The gas coal trade is not quite so much affected, as more of the deliveries are on contracts, and the consumption, if decreasing, is still good for the time of year, and—apart from tonnage difficulties—the production is well taken up. Best Durham gas coals are about 25s. 6d. per ton f.o.b.; second-class gas coals, about 24s. to 25s. per ton; and "Wear Specials," 27s. per fon f.o.b., with a steady demand. But there are occasionally cargoes thrown on the market, through the non-arrival of tonnage that had been arranged for, which may at times be sold at slightly lower prices where prompt steamers can be guaranteed by the buyers. Little is doing in new contracts just at present; and foreign sales are only cautiously entered into. The freight market is very firm, and seems likely to continue so, for arrivals are rather slow. The rates of freight on gas coals are heavy. About 88s. is now quoted Tyne to Genoa, and 33s. to Rouen. So the cost of gas coal at these ports is very high indeed; and even at such a cost supplies are not always to be readily had. In coke, the inquiry is good, and the price is generally maintained. For export, good gas coke is now quoted at about 27s. 6d. to 29s. 6d. per ton f.o.b. in the Tyne; but heavy freights, of course, make the cost far above that usual, and may tend to limit the quantity sent abroad.

Hastings and St. Leonards Gas Company.

Submitting the report and accounts for the half year ended Dec. 31 at the meeting of the Company last Thursday, Dr. G. G. Gray said there was little fresh he had to tell the proprietors. The same unprecedented state of affairs, and the same difficulties and high charges, still continued; and there seemed no prospect of their ceasing or even lessening in the near future. On the contrary, there appeared rather a prospect of their increasing. Owing to the lighting restrictions, the practice of economy, &c., there had been a considerable decrease in the quantity of gas sold, compared with the same half of the previous year. But though they had sold less gas, they had received an increased return; and, on the other hand, though they had made less gas, it had cost them considerably more. The increased cost was seven times as much as the increased return. Of their employees, 42 had joined the Forces; and the Engineer (Mr. C. F. Botley) had directly or indirectly kept in touch with practically the whole of them. The report stated that the accounts showed a profit balance of £10,259, which, with £331 from the balance brought forward, would provide for standing charges and enable the statutory dividends to be paid. The demand for gas appliances was, in the circumstances, well maintained. The cost of all stores, labour, and raw material had still further increased; and, chiefly owing to freightage, it had been difficult to get adequate supplies. The price of gas had had to be advanced as from Jan. 1 a further 3d. per 1000 cubic feet. Mr. James T. Piper, the Accountant, after 58 years of faithful service, had relinquished his more active duties; and Mr. S. Taylor, who has been with the Company for many years, had been appointed Chief Cashier.

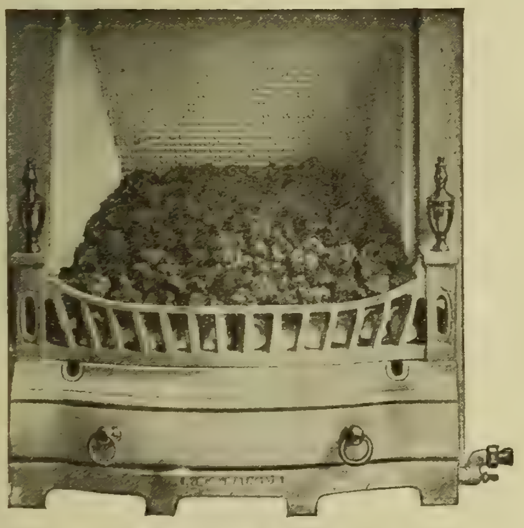
Dividend Distribution at Harwich.—Referring to the question of dividend at the annual meeting of the Harwich Gas Company, the Chairman (Mr. H. J. W. Jervis) remarked that a reduction in consumption of 3 million cubic feet dissipated all hope of maintaining the net profit. The Directors felt justified in recommending a final distribution at the rate of 8 per cent. for the year on the original shares and £5 12s. on the new shares, in view of the fact that, after payment of the interim dividend, there remained at the credit of profit and loss account the sum of £5708, accumulations of former year's earnings. It might be said they could have paid the usual full dividends; but they were of opinion that in these times it was only proper the shareholders should shoulder some of the obligations of the war. Better times would come again. There was nothing that need cause any shareholder apprehension as to the stability of his investment. When the world was held in thrall by the mighty events occurring, their petty affairs assumed an insignificance which was extreme. To meet the heavy increase in the cost of coal, the price of gas to ordinary consumers had been further raised 6d., to 4s. 6d. net per 1000 cubic feet, as from Jan. 1. The contractors for their new quay had brought an action for extras against them. The award was essentially in favour of the Company; but each side was ordered to pay its own costs.

Effect of Reduced Lighting at Southend.

The abolition of street lighting and the enforcement of lighting and other regulations imposed on the locality, resulted in a substantial reduction in the quantity of gas sold during the six months ended Dec. 31. There was, as a matter of fact, a falling-off of practically 16 per cent., nearly all of which is attributable to the cause named. In the report which was adopted at the recent meeting, the Directors stated that the total number of consumers was 18,127, of whom 12,930 had prepayment meters. Owing to considerable economies in working having been effected, and an improved yield of residuals, the increased cost of coal had been borne, with the result that the profit and loss account, after transferring from the reserve fund account the sum of £278, showed a balance of £7559. Out of this, dividends were recommended for the half year on the original and new ordinary stocks at the rate of 5½ per cent. per annum, and on the new ordinary "B" stock at the rate of 5½ per cent. per annum, all less income-tax. This will absorb £7008. Captain Woosnam, who is serving with his regiment in India, owing to his military duties resigned the chairmanship of the Company, and the Deputy-Chairman (Mr. James Randall) declined nomination, on the grounds of age and not being resident in the district. Mr. J. H. Burrows, J.P., was thereupon elected to the office. Mr. W. W. Futcher, for some thirteen years one of the Auditors, had, owing to failing health, intimated that he did not intend to offer himself for re-election. In the course of his remarks to the proprietors, Mr. Burrows said that if they added the figures for wages to that for repairs and maintenance, and compared the total with that for the same half of the previous year, they would find there had been a saving of £118 each week of the six months. In connection with this, he should call attention to the report of the Engineer (Mr. C. S. Shapley), which stated that the work of putting the plant in a thorough state of efficiency was progressing favourably. On behalf of the Directors, he wanted to say that, in spite of this decreased expenditure of £118 per week, the state of the works had been improved. He said it for the encouragement of the Engineer, and as some acknowledgment of his services. In spite of all the unfavourable circumstances, the profit was £551 more than in the same period of the previous year. He pointed out that the Company had started the work of making ends meet by reducing the dividends, instead of increasing the price of gas.

Reservoir Construction Stopped by the Ministry of Munitions. At last Friday's meeting of the Metropolitan Water Board the Works Committee reported that they had received a letter from the Ministry of Munitions stating that, on grounds of urgent national interest, and acting under powers conferred by the Defence of the Realm and other Acts, it had been found necessary to give directions for the immediate cessation of the work being carried out for the Board at the Littleton reservoir works—the plant and machinery being required for the production of war material. The question of liability for any loss or expenditure arising from the cessation of work is, the Committee stated, engaging their attention.

THE MAIN GAS FIRES.



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Blyth Gas Company.

The report for the year ended Dec. 31, which was adopted at the annual meeting of the Company last Wednesday, stated that the revenue was £24,717, and the expenditure £19,488; leaving a balance of £5229 as profit for the year. The balance standing to the credit of profit and loss account was £7011, out of which the Directors recommended the payment of a dividend for the half year ended Dec. 31 on the ordinary stock at the rate of 6½ per cent. per annum, less income-tax, payable on March 2 next. This would absorb the sum of £1788; leaving a balance of £5222. This amount was subject to a sum of £1496 being transferred equally between the insurance and renewal fund accounts, as authorized at the general meeting held in March, 1914—thus leaving a net balance of £3726 to the credit of the profit and loss account. The interim dividend for the half year ended June 30 last was at the rate of 7¼ per cent. per annum; thus making the dividend for the year at the rate of 6⅞ per cent. per annum, less income-tax—the maximum allowed by the Company's statutory powers. The revenue account for the year showed an increase in receipts, when compared with last year, of £1780, and an increase in the expenditure of £1180. In consequence of stringent lighting restrictions the make of gas showed a decrease of 7 per cent. The values of coke and sulphate of ammonia had appreciably increased; while, on the other hand, tar had dropped in value. Coal had risen heavily in price, and, in consequence of this, together with the advanced cost of material and labour, the Directors had found it expedient to increase the price of gas from July 1 by 6d. per 1000 cubic feet. The extensions to manufacturing plant alluded to in the last report were proceeding slowly; material and labour both being difficult to obtain.

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Price of Gas at Neath.—The Neath Town Council, at a meeting last Thursday, adopted a recommendation of the Gas Committee to increase the price of gas from 3s. to 3s. 4d. per 1000 cubic feet.

Gas and Water Supply of Canterbury.—Regret was expressed by Mr. S. Williamson, when occupying the chair at the annual meeting of the Canterbury Gas and Water Company, at the loss sustained through the death of Mr. Thomas Buckley, who had for nearly forty years been in charge of the water department. He said he could not speak too highly of the services Mr. Buckley rendered to the Company. He was a very clever man indeed, and designed a great many alterations and extensions to the water-works. The department has since been in charge of Mr. Swinnerton; while Mr. H. C. Page has been appointed Joint Gas and Water Engineer. Speaking of the business during the past year, the Chairman said it would have been a blessing if Kent coal had been better developed; but unfortunately the quality had up to the present proved so poor that it had only been possible to use about 15 per cent. mixed with North Country coal, though it had been tried over long periods from both Tilmanstone and Snowdown. A dividend was declared making, with the interim distribution, 8¼ per cent. for the year.

South Staffordshire Water-Works Company.

Dealing with the accounts for the year ended Dec. 31, at the meeting of the Company, on Monday of last week, Mr. H. K. Beale, the Chairman, said that they were not quite as favourable as they were the previous year; but he did not suppose the most sanguine shareholder would expect such a good result in times like the present. In company with everyone else, they had been faced with abnormal increases in the prices of fuel and materials and in wages; but they were without the compensating advantage, which the ordinary manufacturer had, of being able to increase their prices in order to meet the increased cost. The prices at which they could sell water were limited by an old Act; and until Parliament saw fit to alter the scale, they were bound by it. The large increase in receipts was chiefly due to the great quantity of water purchased by manufactories making munitions of war; and a substantial amount of it was also due to the fact that they were supplying large military camps. He did not believe they had yet felt the full effect of the increased price of coal, of which they used something like 45,000 tons a year; and it would mean a considerable increase in their expenses next year. A substantial number of large consumers of water had been able to obtain their supplies at under the maximum charge. The Directors had revised the meter charges, and advanced the price to these consumers. The report of the Directors showed that the number of houses laid on during the year was 629, to which there had to be added 750 houses in Penkridge and Great Wyrley transferred to the Company's area of supply by their Act of last year, making the total supplied 145,740. The gross amount of water-rates was £166,705, as against £158,882 in the previous year. The sum of £2000 had been transferred to the depreciation fund, raising it to £55,202. After providing for interest on the debenture stock and the dividend on the preference stock, the amount remaining on the revenue account (including £9537 brought from last year) was £47,899. Out of this, an interim dividend on the ordinary stock at the rate of 6 per cent. per annum, less income-tax, was paid in September; leaving a net available balance of £28,677. A final dividend on the ordinary stock was recommended at the rate of 6½ per cent. per annum, less income-tax; making a total for the year of 6¼ per cent., less income-tax, and leaving £9209 to be carried forward.

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Newark Gas Company.—At the half-yearly meeting of the Company, the Chairman (Mr. T. Bradley) expressed the satisfaction of the Directors at the fact that, despite the anxious time through which they had passed, it had not been found necessary to raise the price of gas beyond 2s. 11d. per 1000 cubic feet. The rise of 3d. per 1000 feet had been absolutely necessary. The receipts for public lighting during the six months amounted to only £16. Some difficulties had been experienced with the men at the works; but these had been surmounted—the Company at the present time paying an exceedingly good rate of wage to all employees. The report was adopted, and dividends declared of 10¼ per cent. on the "A," 5 per cent. on the "B," and 7¼ per cent. on the new ordinary shares.

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¶ Davis activities—guided always by a deep sense of this responsibility—have contributed very materially to Gas Progress.

¶ This is evidenced by the Company's invention of the Hygienic Gas Fire; by the establishment of their Permanent Exhibition Salons in the heart of the Metropolis; but above all by the Scientific Soundness and Constructional Merit of their many Specialities.

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A Good Increase at Reading.

During the past year, the sales of gas at Reading increased by 44,514,300 cubic feet, or 6·44 per cent.; while there was an addition of 1019 to the number of consumers, and 2286 to the cookers and fires supplied. The number of consumers within the borough now closely approximates to the number of inhabited houses. These were the gratifying statements which the Chairman (Mr. J. Okey Taylor) was able to put before the proprietors at the annual meeting. He added that, in these trying times, it was matter for congratulation that they had been able to maintain the price of gas at so low a figure as 2s. 3d. per 1000 cubic feet. This was due to the sound financial position of the Company, which had enabled them to pass through a strenuous period with such satisfactory results. During the year the district of Theale had been taken over; and it was interesting to note that they were now supplying practically the whole of the area over which they possessed statutory power. The increased demand for gas had necessitated the provision of further storage accommodation; and they were fortunate in having entered into a contract for the erection of a new holder at a time when prices were normal. He was afraid, after Midsummer next, if the war continued, they would be unable to supply gas at the present rate. A bonus had been granted to the employees amounting to £1347 per annum, owing to the increased cost of living occasioned by the war. Of 300 employees before the war, 116 were now serving with the Forces. The works had been conducted by their Engineer (Mr. D. H. Helps) with his well-known ability and intelligence. The report was adopted, and dividends at the maximum rate of 5 per cent. per annum on the preference shares and ordinary stock (less income-tax) were declared.

Increase in Price at Lancaster.—Dealing with the accounts of the Gas Department at a meeting last week of the Lancaster Town Council, Sir N. W. Helme, M.P., pointed out that the minutes of the Committee (which were adopted) recommended that the price of gas be increased to 2s. 10d. per 1000 cubic feet to ordinary consumers, and that 27 cubic feet be allowed to prepayment consumers for 1d. It was not proposed to increase the price of gas for power purposes.

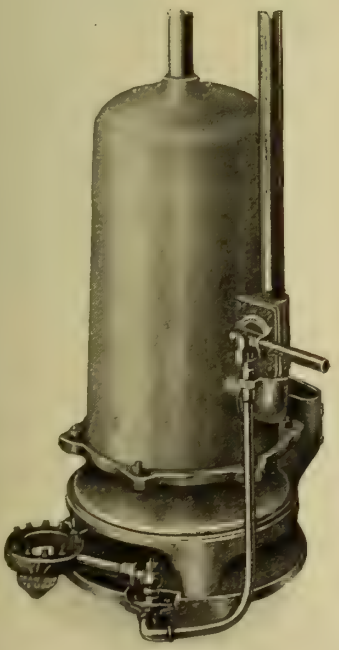
Abnormal Consumption at Leighton Buzzard.—Mr. R. Richmond presided at the annual meeting of the Company, and pointed out to the stockholders that during the past year there had been an increase of 17·2 per cent. in the quantity of gas sold—an abnormal consumption chiefly caused by the billeting of troops in the district. The accounts would, in normal times, have warranted a decrease in the price of gas; but there was every probability of a large falling-off in the profit on the current year's working. The great feature of the accounts was that, after paying the dividend at the rate of 5 per cent. per annum upon the ordinary stock (less income-tax), they were able to carry forward the maximum amount allowed under the Company's Act—namely, "the amount of one year's dividend at the authorized rate."

Aldershot Gas, Water, and District Lighting Company.

The general business of the Company, in all departments, showed progress, the Directors remarked in their report for the half year ended Dec. 31. Sales of gas advanced nearly 19½ per cent., more water was supplied, and the electricity department completed the first year's working with a small, but nevertheless gratifying, revenue balance on the right side. With the co-operation of a devoted body of employees, the Company had fulfilled their obligations without any hitch or restriction whatever. The total revenue for the six months was £57,460, and the expenditure £45,045, leaving a surplus of £12,415. After providing for the dividends on the preference stock, and interest, the Directors recommended the full statutory dividends for the half year of £5 18s. per cent. per annum on the "A" stock, £4 8s. per cent. per annum on the "B" stock, and 5 per cent. per annum on the "C" consolidated stock—all less income-tax. Addressing the proprietors at the meeting, the Chairman (Mr. W. T. Robertson, J.P.) referred to the many difficulties that had been encountered. Touching on the question of labour, he said they employed a great number of men who were more or less experts. The moment the military authorities wanted men who were better than somebody else, they came out into civilian life, and took the best. Needless to say, in their search they found many men who were valuable to them, and as the result the Company had lost numbers of employees who were most useful to them. The Board hoped the war might end before there was any necessity for a further increase in the price of gas. The results of the half-year's working reflected the greatest credit on the General Manager (Mr. R. W. Edwards) and his staff. At a subsequent extraordinary meeting, the Directors were authorized to issue £25,000 of further capital, which the Chairman said had become necessary on account of the extraordinary circumstances in connection with the abnormal consumption of gas.

Canterbury Gas and Water Stock.—At a local auction sale, £1730 of stock in the Canterbury Gas and Water Company was offered, and some portion of it was disposed of, in lots of £10 each, at £17 5s. and £17 per lot.

Gas Supply of Normanton.—Dividends of 6 per cent. on the original stock and 4½ per cent. on the additional stock were declared at the half-yearly meeting of the Normanton Gas Company. Mr. John Armitage, who was in the chair, said the restricted lighting had reduced the output 6 per cent., and the cost of everything had gone up; but still the Directors were able to present a fairly satisfactory report. During the half year coal had cost on the average 4s. per ton more, which represented, on the tonnage used, £657; whereas the increased price of gas, which averaged 2½d. per 1000 cubic feet, had only yielded towards this extra cost £323. So that the benefits accruing from the installation of the new plant had had to go towards making up for the extra cost of coal and other materials.



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Gloucester Gaslight Company.

The half-yearly general meeting of the Company was held on Monday of last week, when, in the unavoidable absence of the Chairman (Mr. R. V. Vassar-Smith), Mr. J. H. Jones (Deputy-Chairman) presided. The Directors, in their report for the half year ended Dec. 31, stated that the high prices at which the contracts for coal were made had very considerably added to the expenditure. The revenue from the sale of residuals had, however, greatly improved. The consumption of gas during the six months had slightly decreased; but the number of consumers had increased, and there had been a satisfactory addition to the cooking-stoves and gas-fires in use. The Directors recommended the payment for the half year of the maximum statutory dividend of 5 per cent. per annum (less income-tax) upon the consolidated stock. The report and accounts were adopted, and the dividend declared.

Northwich Gas Company.

The accounts presented at the annual meeting of the Company showed decreases of £578 in receipts and of £1026 in expenditure, compared with the previous year's working. The profit for the year was £3865—an increase of £448. After paying interim dividends and interest on loans, there remained a disposable balance of £2365. In moving the adoption of the report and balance-sheet, the Vice-Chairman (Mr. W. J. Yarwood), who presided, expressed pleasure at being able to present such a satisfactory set of accounts, which he said reflected much credit on the Engineer and Manager (Mr. J. A. Brentnall) and the staff of the Company. The report recommended that dividends of 10 per cent. per annum (less income-tax) be paid on the ordinary shares, and 4 per cent. per annum (free of income-tax) on the preference shares, for the past half year, making, with the interim dividends, 8 and 4 per cent. respectively for the year. The report (which was adopted) also recommended that £250 be transferred from revenue account towards the cost of the Parliamentary Bill, leaving a balance of £402 to be carried forward.

Newmarket Gas Company.—The report and accounts adopted at the annual meeting of the Company showed that the net profit earned during the year ended Dec. 31 was £3699, which, after deducting debenture interest £162, and adding £3795 brought forward, made a sum of £7322, from which had to be deducted £600 written off investments for depreciation, leaving a balance standing at the credit of profit and loss account of £6732. Out of this, the Directors recommended the payment of a dividend at the rate of 6¾ per cent. for the year 1915 upon the original consolidated stock (less income-tax), £3510—leaving £3222 to be carried to the next account. Mr. R. Stephenson, J.P., who presided, pointed out that the carry-forward would be diminished by £515. The price of gas had been raised 4d., to 3s. 10d. per 1000 cubic feet, as from Jan. 1; and the result was that, under the sliding-scale, they would only be able to pay a dividend of 6½ per cent. next year.

Increased Private Consumption at Eastbourne.

The healthy condition of the business of the Eastbourne Gas Company was shown by the Chairman (Alderman J. C. Towner) when addressing the shareholders at the recent half-yearly meeting. After alluding with the deepest regret to the death of Dr. G. A. Jeffery (who had been Chairman for over half-a-century), he said the earnings of the six months ended Dec. 31 showed a sufficient profit to pay the dividend; but the help of the special purposes fund had been necessary. Built up in happier days, it was properly available at just such a time of stress as the present. The sum of £813 they paid to the dependants of employees serving with the forces, and £378 the cost of insurance against aircraft and bombardment, had been charged to this account. The over-spent capital account, and the heavy stocks necessarily held, had made it requisite to avail themselves of facilities afforded by the Company's bankers; and this explained an item of £447 for interest. There was a total requirement of £8743, while the profits were £574 less than this. The sales of gas for the half year had decreased by 2·27 per cent. compared with a year ago; yet taking the year as a whole there had been an increase of 2·5 per cent. And seeing that the average annual increased sales of gas over the past ten years had been 3·63 per cent., it would be clear that even war times failed to check the steady growth of the Company. The number of consumers had increased by 214. While there was a total decrease in the gas sold of 6,500,000 cubic feet, the reduced sales for public lighting were 11,000,000 feet; so that for private purposes there had been an increased sale of 4,500,000 cubic feet. The cost of coal during the last three years had risen from 19s. 9d. to 27s. 6¾d. per ton. The Resident Engineer and Works Manager (Mr. W. H. Hammond) had achieved excellent results in treating the gas so as to obtain toluol for explosives. Little as the Directors desired to increase the price of gas, it was not unfair to compare the present charge (2s. 10d.) at Eastbourne with that of the largest Company in the world—the Gas Light and Coke Company—who to-day charged 3s. 2d. That Company could bring coal to their own works on the Thames; while Eastbourne no longer had the use of Newhaven and had to bring coal to the Thames or the Medway, and then across Kent, Surrey, and Sussex to Eastbourne. The strong position of the Company lay in their low capital expenditure. About 8d. per 1000 cubic feet sufficed to meet all the demands for dividends and interest. Nearly seventy employees had joined the forces, and probably another twenty would do so. The officers and workmen had combined together to keep the flag flying; and it was felt that their efforts should be appreciated. The report was adopted, and dividends declared at the rates of 7¼ per cent. per annum on the "A" stock, 5¾ per cent. per annum on the "B" stock, and 5 per cent. on the preference stock.

The complete destruction of the Bonaventure Railway Station, at Montreal, has resulted in a loss which is estimated to probably exceed £80,000. The conflagration is believed to have been caused by defective electric wiring in the stationery room.

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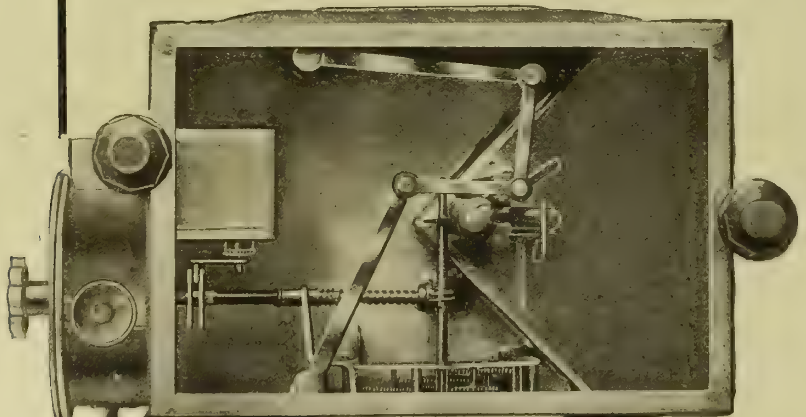

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Plumbers and Reserved Occupations.

The position of the plumbing trade in relation to recruiting, and the serious difficulty experienced by the craft in carrying on public health and Government work owing to the shortage of men, was discussed at a meeting of the Board of Governors of the Institute of Plumbers at Doncaster. The Executive Committee had endeavoured to gain some relief for the trade, but without success. Raising the matter, Mr. J. Allinson said that in the list of scheduled trades which were reserved, mention was made of public-utility services—gas undertakings, light, and power corporations. It was positively ludicrous to say that the man employed laying mains in streets for a gas undertaking should be exempt, and that the man who connected from the mains to the houses of the people and to public buildings was not indispensable. If leakages occurred, he supposed it was the view of the authorities that they might remain for the duration of the war. The same remark applied to water undertakings. In defence of the plumbing trade, they could point to their roll of honour. Great numbers of employees and operatives had joined His Majesty's Forces, and everyone was suffering from the drain on staffs. He submitted that they had now reached a point when it ought not to be possible for the Government to recruit further from their staffs. Several other members stated they were greatly handicapped owing to the loss of men; and it was decided to seek an interview with Mr. Lloyd George personally, to lay the whole position before him with a view to Government action being taken to limit the recruiting of plumbers.

Industrial Gas in South London.—There is an announcement by the South Metropolitan Gas Company in the current number of their "Co-partnership Journal" to the effect that they are now offering a discount off the price of gas used in any process of manufacture requiring the utilization of heat. The Company point out that they are prepared to make a special study of any problem, and to prove the success of their suggestions, before advocating their adoption; and that they "have an offer which is well worth the consideration of all those who desire to reduce their production costs."

Winchester Water and Gas Company.—The revenue account figures for the past half year were larger than they had been in the history of the Company, the Chairman (Mr. J. C. Warner) informed the proprietors at the meeting. In 1905, they had a contract for Londonderry coal, at a cost delivered of 14s. 6d. per ton; while during the past six months coal not so good for the purpose had averaged about 25s. per ton. The extra revenue which they had obtained from an increase of 2d. per 1000 cubic feet in the price of gas amounted to less than one-half the additional cost of manufacture. The increase in the sales of gas came very largely from the prepayment consumers. The report presented showed that the balance of net revenue account available for dividend was £10,348; and dividends were declared for the half year of 4 per cent. per annum on the preference stock and 4½ per cent. per annum on the consolidated ordinary stock.

A Good Half Year at Worthing.

Despite the stringency of the lighting regulations in force over the Company's area of supply, and which had reduced the possible receipts from public lighting by £490, the Directors of the Worthing Gaslight and Coke Company were able to submit a very satisfactory balance-sheet to the half-yearly meeting last Saturday. An expenditure of £4161 had been incurred in connection with the new gasholder at Goring, £2606 on connections to the holder and new mains and services, and £1117 on new meters and stoves during the half year, with the result that the total expenditure on capital account, after allowing for depreciation, had been increased from £147,628 to £153,989. On the revenue account, gas sales had brought in £16,359, an increase of £825 on the corresponding half year; rentals from meters, stoves, and prepayment fittings showed an increase of £111; and sales of residual products an increase of £1779. On the other side, the cost of coals had been £11,303, compared with £10,081—due to the advance of 6s. per ton on the new contract. Altogether the total manufacturing charges showed an increase of £1378, and the distribution charges an increase of £451; the latter being largely due to a considerable increase in the cost of materials. The increase from the sale of residual products, the Chairman (Mr. H. H. Gardner) pointed out, was mainly due to the higher value of coke and improved carbonizing. An increase of £218 from sulphate of ammonia was more than counterbalanced by a decrease of £392 from tar; but plant was being erected which would extract the light oils from the tar, and render it suitable for use on the roads. The Company had obtained 162 new customers during the half year, and had let out 72 additional stoves. Leakage had been reduced to 5¼ per cent. The report was adopted, and a dividend of 5 per cent. (less income-tax), on the consolidated stock, was agreed to.

Metropolitan Water Board Deficiency.—At last Friday's meeting of the Metropolitan Water Board the Finance Committee reported that, in accordance with section 15 (2) of the Metropolis Water Act, 1902, the precepts upon the contributory authorities in respect of the deficiency in the water fund for the year ended March 31, 1915, amounting to £94,873 7s. 4d., were issued on the 12th ult., and were payable on or before June 30 next. The rateable value, on April 6 last year, of the hereditments supplied with water by the Board was £53,414,747.

Gas Plant Breakdown at Wilton.—Referring at a meeting of the Wilton Town Council to a breakdown which had occurred at the gas-works, the Mayor (Mr. W. E. J. Stroud) said that matters were beginning to improve. The breakdown was chiefly owing to the very foul state that the works had got into, for they had been seriously neglected; and the climax came just when the Council were changing their foreman. Then the engine failed; and so it was impossible to get any gas at all. Attempts were made to repair the engine; but nothing could be done with it. Another had therefore been installed; and it was hoped that things would now be all right.

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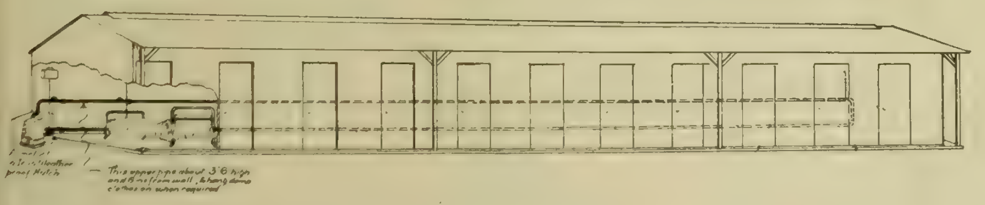
This upper pipe about 3'6 high and 6 ins from wall, to hang damp clothes on when required

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Newcastle and Gateshead Gas Bill.—It was reported to the Gateshead Town Council last Wednesday that a petition had been deposited against the Newcastle and Gateshead Gas Company's Bill, and a Committee appointed to take such action as was considered best in the interests of the borough. Petitions against the Bill had, it was stated, been lodged by the Newcastle City Council, the Felling and Hebburn Urban District Councils, and the Durham County Council.

Fatal Accident at the Derby Gas-Works.—Last Tuesday night Andrew Shaw, a coke shoveller, was killed, and John Fox was seriously injured, through the collapse of some machinery at the Litchurch works of the Derby Gas Company. While engaged at their work, part of a machine suddenly gave way, and crashed down on the two men. Shaw succumbed almost immediately to shocking injuries. Fox was conveyed to the Derbyshire Infirmary in a serious condition.

Price of Gas at Halifax.—On p. 498 of last week's "JOURNAL," there appeared a paragraph, received from a local correspondent, in which it was stated that the Halifax Town Council had adopted the Gas Committee's recommendation of an alteration in the price of gas. We learn, however, from Mr. W. B. M'Lusky, the Engineer and Manager, that the statements contained therein are not correct, though the Gas Committee have at present under consideration certain reductions in the price of gas.

Tipton Gas and Water Affairs.—Yesterday (Monday) week, at the meeting of the Tipton District Council, it was reported that a letter had been received from the National Union of Gas Workers and General Labourers, applying for an increase of wages on behalf of men employed at the gas-works. The matter was referred to the Gas Manager (Mr. William Prince), the question to be left to his absolute discretion. It was also decided to resist any attempt of the South Staffordshire Water-Works Company to increase the water-rates.

Electric Charges at Birmingham to be Raised.—At to-day's meeting of the Birmingham City Council the Electric Supply Committee will ask sanction to an increase in charges. The current given by the department is divided into four classes: (1) Lighting, (2) power, (3) high tension, (4) traction. As regards (1) lighting and (2) power, the Committee are of opinion that it is undesirable to issue a fresh scale of charges. They consider that any increase made should be in the nature of a percentage addition to the total account; and the requirements of the department will be met if an increase of 15 per cent. is made on all charges in the scale under "lighting," and 20 per cent. on the charge for "power." They recommend that these increases be approved, to take effect from the March reading of the meters. The high-tension supply (3) is given under special agreements which now contain a coal clause, advancing the price of current with a rise in the price of coal; and the increased revenue derived from this source will compensate for the advance in costs. As opportunity arises, old agreements without the coal clause are being terminated, and the new form substituted. The Committee propose to apply to the traction supply (4) the terms of the coal clause in the high-tension agreement.

Abolition of the Index Test at Manchester.—The Manchester City Council agreed at last Wednesday's meeting to the proposal of the Gas Committee [*ante*, p. 491] to discontinue the testing of the indices of gas-meters, and in future simply to comply with the requirements of the Sales of Gas Act. The Chairman of the Committee (Alderman Kay) said that the argument for the testing of drums and indices of meters had disappeared so far as Manchester was concerned, because only dry meters were now used.

Coal Shortage in Birmingham.—For about an hour-and-a-half during the afternoon on Monday of last week, there was a stoppage of the Corporation tramway service in Birmingham, owing, the Electricity Committee stated, to the fact that, through the bad weather, the supply of coal to the department had been very seriously curtailed, Stocks therefore became exhausted; for since the outbreak of war, it has, of course, been impossible to accumulate large reserves, which led to the department being continually at the mercy of a dislocation of coal traffic. Fortunately, the Gas Committee offered some help.

Barrmill's Water Supply.—Last Saturday the scheme for the supply of gravitation water to the village of Barrmill was inaugurated, when the ceremony of turning on the water supply was performed by Mr. B. M. Knox, of Redheugh. The water is supplied through an arrangement with the Beith Water District—a main having been laid to the village from the Beith filters. The main is almost two miles long, and will supply the district with about 3 million gallons of water annually. Mr. Knox was presented with a silver rose-bowl as a memento of the occasion. The work was carried out by Messrs. Warren and Stuart, of Glasgow, and cost about £2000.

Cork Gas Consumers' Company.—Presiding at the half-yearly meeting of the Company, Mr. W. B. Harrington expressed deep regret at the loss of Mr. George Lynch, who had been a Director for forty years, and Chairman about half the time. As to the business of the half year, he said the troubles in regard to freights, coal, and general expense had increased; and, in the matter of coal, they had at times the greatest difficulty in securing any at all, and had to take what they could obtain at enormous cost. Worse still, the odd cargoes that did arrive were unsuitable for their plant, and caused no end of trouble at the works. The pipes which conveyed the gas from the retorts got so choked-up that it was with the greatest difficulty the supply was kept up. Recently, however, they had been having the right quality of coal, and he had every reason to believe that the supply would continue to be normal. In consequence of the increased expenses under every heading, they had had to reduce the dividend, and this notwithstanding the advance of 6d. per 1000 cubic feet to private consumers. They had also been compelled to increase the price by the same amount to the Corporation for public lighting. The difference in the cost of freight would mean on the amount of coal they used in twelve months fully £25,000 in excess of what they were in the habit of paying. There had been an increase in gas consumption during the past six months. The report was adopted, and a dividend was declared at the rate of 7 per cent. per annum for the half year.

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Record Sales at Harrogate.—The quantity of gas sold by the Harrogate Gas Company during the year 1915, the Directors stated in their report, was the highest on record—330,462,000 cubic feet, compared with 303,929,000 feet for 1914, or an increase of 26,533,000 feet. The business of the Company had been progressive, particularly in connection with sales of gas cooking and heating stoves.

Labour Question at Kirkcaldy.—The Manager of the Kirkcaldy Gas-Works (Mr. James Kincaid) is to take whatever steps he thinks necessary to secure men. It is suggested by the Committee that the Minister of Munitions may be approached with a view to getting some experienced men released from service with the national reserves. Employees are leaving Kirkcaldy to take up work at the new Admiralty Dockyard at Rosyth.

Belfast Gas Supply Profits.—At last Wednesday's meeting of the Belfast Corporation (after a motion to refer to the matter back had been defeated), the minutes of the Gas Committee were passed, containing the following resolution: "That the Council be recommended to authorize this Committee to grant £11,344 10s. 1d. for payment of the dividends and interest on the capital expenditure in connection with the City Hall, and also (provided the financial position of the undertaking will warrant it) up to a further sum of £10,000."

Prague Water Supply Cut Off.—News has been received at Amsterdam (through the Central News) that, owing to the collapse of a conduit belonging to the Prague Water-Works, the water conveying system has broken down. The interruption of the supply is so serious that a number of industries have had to close their works.

Almondbank (Perth) Gas Supply.—Complaints were recently made as to the unsatisfactory supply of gas for the Almondbank district of Perth; and Mr. David Vass, the Gas Manager, mentioned that before the connections were made to Almondbank the pressures of the gas there and also at the town's mains were taken, showing that there was evidently an ample gas supply for the district. The chief cause of any defect was, he said, the large quantity of gas used when certain singeing machines in the district were in operation. To remove the obstacles and provide an adequate supply they would require a high-pressure main from Perth, which he mentioned in a report he made eighteen months ago. Owing to the increased cost of materials, however, his estimate of the necessary work was a little over £3000, compared with £1350 when he reported originally. Mr. Vass has now been instructed to again take the pressures of the supply of the district, and ascertain if the restricted lighting had had any effect upon the supply for the place.

STOCK MARKET REPORT.

The Stock Exchange had another quiet week. The general tendency was dull. A cardinal point of attention was, of course, the desperate thrust of the Germans towards Verdun. But the calm and unperturbed confidence of our Allies in their power to defeat this enterprise has deeply impressed our own people; and the general sentiments regarding the issue are eloquently proclaimed by the conspicuous market strength of the last French loan. In our own Government securities, the War Loan and Consols have been easier—not unnaturally when the advent of another War Loan at no distant date is borne in mind. So the inclination is to "wait and see." Home Rails had but a poor week; but just before the close one or two lines picked up a bit. Americans were dull and inactive, partly from political factors and partly to the contraction of the market previously adverted to. Canadians did not win the support to which the fine business that they are, and have been, doing entitles them. In the Foreign Market, in addition to the French loan, strength was shown in Japanese, Portuguese, and Brazilian. South Africans were irregular. In the Miscellaneous Market, some of the more popular lives moved irregularly. Rubber and copper shares were affected by Government measures in regard to restrictions in dealing with the raw article; and oils and banks swayed. Some degree of dulness was imparted by disappointing dividend announcements by a couple of big concerns dealing in cement and insurance respectively. Among points of interest, the extension of the Dollars Mobilization Scheme still hung fire; the Treasury apparently being unable to arrive at an acceptable basis of borrowing and purchase powers. The position of the French-held securities scheme is regarded in the House with much dissatisfaction. Business in the Gas Market again showed more activity; and bargains were well distributed throughout the list of issues. Prices in one or two lines were easier, but steadiness was the general rule. In the Money Market, conditions were quite easy.

Bargains done for cash during the week were as follows: On Monday, Commercial 4 per cent. 73¼, ditto 3½ per cent. 68, Croydon 181½, 182½, Gas Light ordinary 73½, ditto preference 74¾, 75, ditto debenture 60, Primitiva 2⅛, ditto preference, from 71s. to 73s., South Metropolitan 75⅜, 75½, 76. On Tuesday, Brentford debenture, 74, 74⅜, Commercial 4 per cent. 72½, 73, European 12¼, Gas Light ordinary 72¾, 72⅞, 73, 73⅛, 73⅜, ditto preference, 74½, 74¾, 75, ditto debenture 61, 61⅛, Imperial Continental 63¼, 63½, 63¾, Primitiva 2 to 2 1/16, ditto preference 70s. to 72s. 6d., South Metropolitan 75, ditto debenture 60⅝, 60¾, South Suburban 82¼. On Wednesday, Commercial 4 per cent, 72½, 72¾, Gas Light ordinary 72½, 72¾, 73, 73⅛, 73½, ditto preference, 75, 75½, ditto debenture 61, Imperial Continental 62½, South Metropolitan 75¼, ditto debenture 60¾, 61. On Thursday, Commercial 4 per cent. 73, Gas Light ordinary 72½, 72¾, 73, 73¼, ditto preference, 74¾, 75, ditto debenture 60½, Melbourne 98⅜, Primitiva 2⅛, ditto debenture 82. On Friday Gas Light ordinary 73¼, ditto debenture, 61¼, Liverpool 87¾, 88, Primitiva 2 1/32 to 2⅛, ditto preference 70s. 7½d. to 72s. 6d., South Metropolitan 75½. On Saturday, Brentford "B" 82½, 83, Gas Light ordinary 72¾, 73¼, ditto preference, 75, 75¼, ditto debenture 61, Imperial Continental 60, Primitiva preference, 43s. 6d., South Metropolitan, 76.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
333,110	10	,,	7	7/-	B 7 p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 8	..
734,920	,,	,,	†11	55/-	Do. New	204—209	5 5 8	82½—83*
55,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	74—74⅜
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	72½—73¼*
560,000	,,	,,	5¼	46/8	Do. 3½ p.c. do.	103—105	5 1 6	68*
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	181½—182½
492,270	Stk.	—	6	5¾	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	12¼
16,327,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	72½—73½
2,600,000	,,	,,	3½	3½	3½ p.c. max.	76—79	4 8 7	..
4,062,235	,,	,,	4	4	4 p.c. Con. Pref.	96—99	4 0 10	74½—75½
4,674,850	,,	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	60—61¼
130,000	,,	,,	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
181,000	Stk.	Mar. 12	7⅞	7¼	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	5⅞	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	60—63¼
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 6	..
2,498,905	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	87¾—88
					B	146—148	4 14 7	
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	98⅜
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,875,892	Stk.	July 29	4½	4¼	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅝	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 3	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	5	—	Primitiva Ord.	5½—6	6 13 4	40/-—43/6
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4¾—5	5 0 0	70/-—73/-
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	82
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 8	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75—76
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60⅝—61
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	82¼
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	135—138	5 8 8	..
782,275	,,	,,	6	6	B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	.
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅞	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	5 2 0	..
852,000	,,	,,	6¼	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

* Ex. Div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

A Satisfactory Year at Carmarthen.—At the annual meeting of the Carmarthen Gas Company, presided over by Mr. John Lewis, the Directors reported that during the year 25,675,000 cubic feet had been sold; being an increase of 1,249,000 on the preceding twelve months. The Chairman said it was gratifying to be able to submit such a satisfactory result of the year's working. Mr. A. Soppit said that it was a curious fact that the experience of most gas companies was that when electric light came into competition with gas the takings of gas companies seemed to go up in every case. The report was adopted. Dividends at the rate of 7½ per cent. per annum, and 7 per cent. on the new ordinary shares, were declared for the year.

The Works Committee of the Southwark Borough Council report that they have received a report from the Borough Engineer to the effect that he has been in communication with the South Metropolitan Gas Company and the Gas Light and Coke Company with a view to reducing, on account of so much of the lantern having to be shaded, the amount of gas consumed. This conversion, the cost of which was very small, would be the means of effecting a considerable saving; and they had given instructions for the necessary work to be proceeded with.

The report for 1915 of Messrs. John Wright and Eagle Range, Limited, states that the balance of the revenue account for the year (after augmenting the contingent reserve), including £11,209 brought forward from the previous year, is £67,302. After deducting the interim dividends (£18,364) paid in August last, there remains at disposal the sum of £48,938, which the Directors recommend be appropriated as follows: To pay a dividend at the rate of 6 per cent. per annum for the half year on the preference shares (less income-tax), £2136; to pay a dividend of 2s. 6d. per share on the ordinary shares (free of income-tax), £26,800; to carry to reserve fund, £8000; and to carry forward to next year, £12,002. The profits on the gas-stove business have suffered considerably through the war; but this has in great measure been compensated for by these conditions having led to an exceptional development of the Company's business in industrial and other apparatus, and by the increasing increment yielded by the expansion of the Company's subsidiary business in directions outside the gas industry.

The British Vice-Consul at Baku (Mr. A. E. R. M'Donell) intimates that the Municipality of Baku are desirous of receiving tenders for the supply and delivery of 2170 water-meters of various types and of different capacities. No date for the receipt of tenders is given; but firms are recommended to forward them as soon as possible. Copies of the specification, in English, may be obtained by United Kingdom manufacturers of water-meters at the Commercial Intelligence Branch of the Board of Trade, No. 73, Basinghall Street, E.C.

The Bradford Chamber of Trade have vigorously protested against a circular recently issued by the Bradford Gas Department, inviting employers of labour, caterers for workpeople's meals, and others, to visit the department's show-room in Darley Street to witness demonstrations of a certain make of patent self-feeding water-boiler by gas, with a view to purchase. The protest of the Chamber is that of the keen controversy when the show-room was originally opened—that the place should not be used for sales, but only for demonstrations in order that the public may patronize local plumbers and gas-fitters by a wider use of gas. It is contended that the department promised to work on the latter lines, and it is also held that the particular boiler can be obtained through any plumber, and that, in any case, the Corporation should not push any particular make.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

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EDITORIAL NOTES.

Fuel Economy Campaign—Developing Plans.

FRESH ground was opened by Professor W. A. Bone, F.R.S., in the fuel economy campaign on Monday last week, when he addressed the members of the London Section of the Society of Chemical Industry, and sought to enlist their active sympathy and support in the matter, because, as he says, unless the British Association Committee who are dealing with this question have behind them the necessary driving power to enlighten a non-technical public, their labours will be largely in vain. This is true; but chemists generally ought not to need any urging in this matter, for it is pre-eminently one that the interests of their profession require should be earnestly taken up. Fuel economy stands for larger chemical control in industries and chemical opportunities through a reduced destruction and greater recovery of the valuable constituents of coal. The British Association Committee desire not only that the influence of chemists shall be brought to bear in every possible useful direction, but that their experience and knowledge in connection with different branches of industry, so far as the experience and knowledge have application to the subject in hand, shall be drawn upon in the way of helpful suggestion and criticism.

The inquiry that the Committee have undertaken is a large one; and, unless it is approached and dealt with in a systematic manner, absolute failure so far as any good goes is a certain result. From the vastness of method that suggests itself, Professor Bone and his Committee have properly decided to prosecute the work on a sectional plan—that is to say, divide or group up the uses of coal, and for each division an Investigating Committee has been appointed, with a competent Chairman. The initial work which these Committees are to pursue is to endeavour to arrive at, by the aid of collected definite data, a judgment as to the approximate average fuel efficiencies actually realized in industrial and other operations, the highest average efficiencies which may be expected by the utilization of the best available appliances and methods, and the probable margin of economy. The lines of the plans of initial procedure are supported by Mr. Charles Carpenter, D.Sc, the President of the Society of Chemical Industry. There is no question as to their wisdom; and for very good reasons. It will largely depend on the case that these Committees are able to prepare and submit, whether there will result any effective action in promoting the end sought. It is no use, in the first instance, trying to stir up the public to back a movement for securing Government aid in fuel economy. The public, experience proves, will not be deeply stirred by any movement which has not upon it the seal of governmental authority, and sometimes not even then. If only they could be so stirred, if they could be made to realize before the Government what this fuel economy question really means nationally, and to act upon the realization, then the work of the British Association Committee would be a long way on the road to completion. Failing the appreciation of the public that this is largely their question, and thus the impossibility of doing effective work without Government recognition and aid, then the Committee have first to pave the way to convincing the Government that here is a matter of far-reaching importance in which, in the national interests, it is their duty to pass from a passive to an active attitude. But how the Government can best help is a matter that is in a state of embryo in the minds of the British Association Committee. The whole movement is new and must undergo evolution, by the application of intellect and work, just as in other mundane developments.

However, having secured and compiled the data as to realized and possible average fuel efficiencies, Professor Bone tentatively suggests that the Government might help either by the establishment of Fuel Advisory and Central Boards, or by providing all that is requisite for large-scale experiments in a central fuel experimental station; or both. All the proof that the Committee can obtain that there is national economy, and therefore money, in what is proposed will be required to stimulate the Government to move in the matter. There is, too, the question of finance. Providing that the handling of the scheme by the Government was on practical lines, any requisite money invested in it from the nation's ordinary resources would be nationally profitable manyfold. In a matter of this kind, this would be the proper way to finance the scheme. But Professor Bone points out there is a simple way by which an abundance of money could be obtained for the work. Professor Armstrong recently at Newcastle suggested a small tax for the purpose on all coal raised; but Professor Bone prefers the revival of a tax on export coal of 1s. per ton, which, he says, would provide 5 million pounds sterling a year. The figure is somewhat beyond the actual. The exported coal in the bumper year of 1913 was 73,400,000 tons; and 1s. per ton on this would realize £3,670,000. The coal owners and the shippers would, of course, again rise up in arms against the proposal. But when the coal export tax was previously imposed, when British coal was high in price before and after the great coal strike of 1912, and during the present war, we have had lessons which show that price does not affect the demands of other countries for our coal. Another 1s. per ton on pithead prices in peace times would therefore do no manner of harm to British interests either in coal or shipping; and, if the proceeds were properly expended for such practical ends as the one suggested, our national interests would undoubtedly be promoted.

So far as to the lines of the plans that are receiving initial materialization, and that are in the minds of the British Association Committee regarding prospective development. Incidentally, there is a matter that comes close home to the gas industry. One of the divisional Committees is charged with the duty of collecting and collating information from the industries engaged in the carbonization of coal; and it is rightly said by Professor Bone that our knowledge concerning combustion and distillation is empirical. We believe he used the word "entirely," but "largely" would be hardly so sweeping, and certainly less condemnatory. But practice must continue in the main empirical, until thorough chemical investigation gives a clearer insight into the real nature of the complexity of the constitution of coals, and the methods of their decomposition by heat. Mr. Carpenter endorsed the deficiency of knowledge, and the existence of the empirical in carbonization so far as the gas industry is concerned. The distillation of coal in closed vessels has much about it that is still hidden from even the most erudite among coal carbonizers; and there are confessedly many unsolved problems that offer a vast field for scientific exploration work. Enlightenment would probably do much to help to place coal carbonization on a higher plane of profitableness. But, all the same, empirical though the gas industry largely is in the matter of carbonization, in making the indictment credit might have been given for the extraordinary advances that have been made by it in the economy of the coal it requires for producing its coal gas—not only through the increased production per ton of coal used, but through the utilization, when oil prices are favourable, of a large portion of its coke production. Without, however, taking carburetted water gas into calculation, nearly 2000 cubic feet more gas are now being made per ton of coal on an average throughout the country than was the case about a decade ago; and this means on the 16½ million tons now carbonized, a production of 33,000 million cubic feet of gas more than if the gas industry was still working to the make of a decade or so ago. Without reckoning the saving effected by carburetted water gas, the gas industry is economizing to the tune of about 2¾ million tons of coal, compared with ten years since. Truly, not a bad record in economy, despite our carbonization practices being largely empirical!

Gas Workers and Exemption.

At the beginning of this great and fearful war, and for several months after, the Allied countries paid an enormous and terrible penalty in life, territory, property, time, reputation, and in other ways, for a deficiency of high explosive shells, and of guns with which to deal with them. The deficiency has been largely redressed; but the level at which the production of high explosives has in this country to be maintained, and exceeded, in view of the huge requirements of the Allied forces, means that nothing must be allowed to intervene to prevent the sources of their supply being developed to the utmost extent. But if the responsible heads of the Government departments that are working in different directions in connection with the war have not the scales removed from their eyes, and their work is not better co-ordinated, there is a very good chance that there may be a gradual reversion to a shortage of high explosives. To those engaged in the work of the gas industry, the discordant acts of various departments are one of the amazing features of the war. For instance, those responsible for the securing of men for the country's Forces, are not the responsible chiefs of the department deputed to look after the supply of high explosives; and apparently they are so ignorant of the actual situation that men continue to be removed from the work of the gas industry into the military ranks, thus progressively tending to jeopardize the maintenance, and to effectually hinder the enlargement, of the source of the supply of the requisites for the manufacture of high explosives. Those charged with the duty of allowing or disallowing exemptions sadly need a few plain facts forced upon their attention; but the difficulty is to get them to pay heed to anything that is plain, other than their own particular objective.

The narrow and undiscerning attitude in this respect was well illustrated the other day at a meeting in the City, when it was stated, by a speaker representing the Government, that it must be recognized that the requirement of men for the country's Forces must take precedence over the requirement of men for industry. This is freely acknowledged up to a point; and, at this point, it is submitted that, so far as the gas industry is concerned, the statement requires very important qualification. In the gas industry men are as essential as coal; for a deficiency of the one or the other means that the volume of the gas supply must be seriously interfered with. And if the volume of gas supply is reduced, it means that the source of important essentials to the production of high explosives is also lessened. We are not prepared to lay much stress on the point as to the further depletion of the man power of the gas industry affecting (important though this is) the gas service from the point of view of the community, seeing that all the public services have been seriously interfered with through the same cause, and we have all to share in the inconveniences and losses so occasioned. But if the Government require the gas industry to maintain its services in connection with the war (the Ministry of Munitions are ever crying out for more and more toluol, and munitions factories demand full supplies of gas), then the Government must spare the industry further inroads upon its men—its men engaged upon the work of the district, as well as those employed in the manufacturing processes. And for the simple reason that it is no use making any more gas than can be sold. The producing capacity of many gas-works is to-day very far in excess of the need through the necessary street and shop lighting restrictions, and the shorter hours of the opening of licensed premises. These restrictions mean the curtailment of the output of gas, and consequently of the source of toluol. So, if the Government require the gas industry to go on increasing the supply of toluol, then the work of producing gas-consumption compensation through new connections in the districts of supply must not be impeded. This is obvious to gas men, for whom we are not writing. Apparently, however, there is inappreciation of the fact in those quarters (and it is to those quarters to which our remarks are addressed) in which repose supreme rule in the matter of exemption from enlistment. To them we emphasize the point that the district work of gas undertakings must not be interrupted, if the best possible is to be done within the gas-works. We know that it is argued that the district men who are engaged on new installations cannot be regarded as necessary for the maintenance of existing gas supplies. That is a pure fallacy. The operations of the district (not only in respect of new business, but upkeep of the distributing plant) can no more be detached from the operations of the works than the arteries and veins in the human system can be said to be dispensable to the functions of the heart.

But what do we see? The gas industry has already sent into the country's service in connection with the war many thousands of men; and the industry is not asking for anything unreasonable in desiring that a stop should now be made to the drainage of its skilled man power. There is, however, evidence that those responsible for the building-up of as big armies as possible are intent on that end, and no other; and the gas industry will, if there is not a speedy change, have the limits of its capacity for national service drawn in much closer than they are at the present time. We commend this point to those who ask for more benzol, toluol, and other substances. It is for them to come to the aid of the gas industry. Until recently no skilled gas workers were to be allowed to join the Forces unless their employers certified that they could be spared. But the latest list of "certified occupations" only embraces skilled workmen inside the works; and the right appears to be withdrawn from the engineer or manager of saying whether or not he can dispense with the services of a man. Some of the members of the technical staffs of gas-works and some of the workmen are authorized to wear the war service badge in connection with the recovery of toluol; but the work of these men is in reality of no more importance to the country than is the work of other men engaged in the several necessary contributory manufacturing processes and those engaged in carrying on the work whereby the gas and other products are disposed of. The washing of gas for the extraction of toluol is simply an intermediary, and not a fundamental process, but one over which, of course, great care has to be exercised. If toluol were the primary product of a gas-works, all the rest of the work that is now done would still be necessary to efficiency and economy in its production. Therefore, unless prompt action is taken, it is quite clear, from decisions in some localities, that very few unbadged gas-workers will be exempted from military service; and, from a statement in the House of Commons recently, it has been made known that the number of reserved trades is to be reduced, and so are the lists of the badged men. The gas industry will not be spared—though, as Colonel Winston Churchill would put it, its work ought to be carried on at "full blast" in the national interests—without urgent and successful pressure be brought to bear in the proper quarters to secure the total exemption of the skilled and technical workers remaining to the industry, or, at any rate, to obtain the restoration to employers of the right of saying whether a gas-worker is indispensable. Anyway, a very serious national responsibility rests upon those who are depriving gas undertakings of further men; and in saying this we are not asserting more than the conditions warrant.

Train Lighting and Uncorroborated Evidence.

The report of Lieut.-Col. P. G. Von Donop upon his inquiry into the circumstances attending the railway collision, near St. Bede's Junction, on the North-Eastern Railway, on Dec. 17, has been issued. Following precedent, gas lighting on trains is again condemned, and electric lighting is recommended. This sort of thing (though evidence time after time is most conflicting) is becoming quite a fetish with the Railway Inspectors of the Board of Trade, while the Inspectors engaged in the work of other Government departments do not appear to trouble themselves, though faced by a long roll of fatalities, regarding the expulsion from mines of electricity used for power purposes, with a recommendation that its place be taken by compressed air, or from factories and workshops, with a proposal that other forms of power, with fewer mantraps associated with them, should be adopted. But though the Board of Trade Inspectors on every opportunity of a railway accident and a fire on a train reiterate their standing recommendation, we still wait for one of them to urge that this matter of the alleged contribution of gas to train conflagrations after accidents should be made a matter of competent technical investigation. It cannot be expected that men, with a military engineering training and experience, can have a complete knowledge as to what happens in the case of gas escaping from high-pressure cylinders when broken open or with the connections violently detached. It would be only fair to the railway companies and to all interests if, before the Board of Trade press this matter further, such an investigation were made.

There has been careful perusal of Lieut.-Col. Von Donop's report and the evidence that was put before him; and, we say with all respect, that it is impossible to subscribe to the statements that "the evidence that the fire [in this instance] originated with gas is more definite than in any "previous case," and that "it furnishes a very conclusive "object-lesson as to the additional danger which is caused "in the case of an accident by the presence of gas on the "train." It is a bad practice (and very few intelligent people adopt it) to always accept statements at their face-value. Bearing this in mind, it is well, before accepting as final Lieut.-Col. Von Donop's view, to look into the character of the "definite evidence" and the "conclusive object-"lesson." Taken as a whole, the evidence is peculiarly contradictory; and there is an entire absence of corroboration of the particular part upon which the Inspector mainly relies. As a matter of fact, it was the only piece of testimony that could at all support the conclusions arrived at, and therefore the condemnation of gas, and the recommendation as to electric lighting. The Inspector says: "The "evidence appears" ["appears" does not suggest conclusiveness, and the evidence is that of one witness out of several] "to point to the fire in this instance having originated with the ignition of a jet of gas which was escaping "from one of the gas cylinders [which gas cylinder?] of "one of the leading vehicles [which of the leading "vehicles?]; that this gas-flame then set light to the "wooden upper portion of that vehicle, and that that in "turn set light to the inflammable portions of the two other "vehicles which were lying near it." Why on earth did not the jet of gas actively commence its nefarious work upon the oil-impregnated woodwork under the carriage, instead of going out of its way to begin destructive operations upon the wooden upper portion of the vehicle? The conditions, taking them in their entirety, are most peculiar upon which to place definiteness and conclusiveness. The witnesses differed as to which of the two wrecked vehicles was the one where the fire started. Some witnesses stated, too, that the fire had its origin under one of the carriages; while another alleged it began at the top. The Inspector himself dismisses the statement as to the top, but reports that it was the "upper portion" of one of the leading vehicles that caught fire! If we turn to an earlier part of the report, he mentions that "the whole of the upper portion "of the leading vehicle and the front portion of the second "vehicle were subsequently consumed by fire." Yet the fire is alleged to have been started by a gas-jet from one of the cylinders situated well up in the framework under one of the carriages; but nowhere is it stated that the lower part of the woodwork of the carriage was destroyed.

The evidence all appears to confine the start and the intensity of the fire to the leading vehicle, the rear portion of which was telescoped inside the second one. The testimony upon which the Inspector has relied is that of Driver Tolliday (who seems to have been extremely busy in various ways during the awful experience, and deserves all the praise that the Inspector bestows upon him). He was travelling in the second vehicle; and he says that, when working, after the accident, rescuing passengers from the next compartment to his own, it "*seemed*" to him "the fire broke "out at the gas-cylinder immediately under the compart-"ment at which we were at work." After this "seeming," he became more emphatic, and said: "I saw a small jet of "fire rising from the top of the gas-cylinder." Now this must have been under the second vehicle; yet it was the first one in which, the evidence shows, the fire burnt with the greatest intensity, and the one which suffered most. We credit Tolliday with giving his evidence quite honestly, and with believing that he actually saw a jet of flame coming from one of the gas-cylinders. Nowhere in the report, however, is the cylinder positively specified from which this jet of flame was supposed to be issuing. Tolliday did not denote it particularly; but his evidence would suggest that it was one of the cylinders under the second vehicle. There was only one of three cylinders—10 cubic feet capacity at atmospheric pressure (only one of this size would be required with incandescent lighting) left intact on the front vehicle; and in this case all the connections were broken. The pressure of the gas in the cylinders on this coach was probably about 75 lbs. per square inch! The cylinders on the second vehicle were all intact, except the leading right-hand one, which had a connection broken; but the low-pressure pipes were all severed. It is really a bit of a mystery as to the exact location of the "small" jet of fire, if actually occasioned by gas. It may have arisen from something else burning on top of one of the cylinders. Anyway, it would be interesting to know whether Lieut.-Col. Von Donop himself traced in the top of one of the cylinders a perforation where a small jet of gas could have been burning. If the gas had not escaped, then, with the connections wrenched off, it is curious that other similar gas-jets were not seen. Another thing against the gas theory is that the fire does not appear to have occurred promptly after the accident. Quite an appreciable time, according to some of the witnesses, elapsed before fire broke out, whereas the ignition of gas would more likely have taken place immediately (if at all) upon the accident, and not after an interval, when the gas would have been largely, if not entirely, dispersed. Then the flame would have attacked first the oil-impregnated wood in its proximity, and not first, by some mysterious means, the upper part of the woodwork. Instead of the evidence being "definite" and this a "conclusive object-"lesson," it is one of the most extraordinary pieces of inconclusiveness that could possibly be presented.

In this case, Lieut.-Col. Von Donop says that, in some railway accidents that have been accompanied by fire—such as those at Witham, Grantham, Hawes Junction, and Ditton—it was found that the fire had originated with escaping gas. But Major Pringle, in his report on the Hawes Junction disaster, said: "This is actually the *first* "*occasion* when it can be proved beyond question or doubt "that fire was occasioned by burning gas. It has to be re-"membered, also, that gas has been in use for lighting pur-"poses for a very long period, and that during the whole of "that time—in fact, since the year 1868—there is no case "of fire destroying either the lives or bodies of passengers "in railway accidents." In his report on the Ditton Junction disaster, Lieut.-Col. Yorke said, in fairness to the London and North-Western Railway Company, that gas had been in use upon their trains for thirty years, during which period 2937 million passengers had been carried; and this was the first occasion on which it had been suggested that gas had been concerned in burning one of the Company's trains. In all the cases mentioned in the present report, there was room for considerable doubt as to the fires having "originated" with gas; but, over the last three years, the Inspectors of the Board of Trade have shown a consistency of belief in regard to this matter on the most unreliable of evidence—evidence having its origin under conditions that could not possibly produce certainty.

Gas-Works Coal Supplies.

Gas undertakings and electricity supply stations are variously suffering—the condition is growing acute in several cases—from shortage of coal; and this applies equally to some concerns near the coal-fields as to some at a distance. Numerous gas-works were successful last summer and autumn in considerably supplementing their stocks; and had many of these not been so prudent, they would now, through the falling away of deliveries this winter, have been high and dry for coal—in fact, we know instances where normal stocks for this period of the year would by this time have completely vanished. There are other works where, while some of the contractors are well up to time with deliveries, others are very seriously behind; and the position has become one of such extreme gravity, that some of these works will have to go on to the open market to purchase supplies at current rates. The recent bad weather has not improved matters—not only on account of the greater output of gas for heating purposes, but of the increased difficulties of transport. Owing to the weather, railways have not been able to run with even their war-reduced efficiency. Sea carriage, too, has been shortened due to rough seas, wind, and fogs. At the mines, operations, owing to the bad weather, have likewise been impeded—thus accentuating the shortage. There is no doubt, looking at the situation generally, that had it not been for the Price of Coal (Limitation) Act, there would have been witnessed a considerable rise in prices, and just at a time when negotiations for contracts are being entered upon.

District Supplies Committees.

Present experiences do not improve the outlook for accumulating stocks for next winter. These experiences will make every industrial concern—including gas, electricity, and water undertakings—look energetically after itself in this respect. The District Supplies Committee, with the Central Committee, appointed by the Board of Trade may, however, do something to ease matters, seeing that their first duty is to ensure that munition firms and other important consumers obtain the supplies they need with as little delay and friction as possible. The supply of high explosives, and the feeding of munition works with gas and coke, make gas undertakings highly "important consumers" of coal; and the Government cannot possibly afford to allow their supplies to run short. If in certain areas the supply to gas undertakings does not improve, as a result of the District Committees, it will be necessary to make very direct and strong representations to the Government regarding the matter. Of course, the coalowners have a big incentive to work for the home demand being fully met; for they have been informed that the issue of export licences depends very largely upon the condition of the home supplies. At the same time, it must be recognized that some interference with the normal distribution of coal cannot be altogether avoided. We remarked that the newly appointed District Committees "may" do something to ease matters. The indefiniteness of "may" is necessary, as the powers of the Committee appear to be very limited; seeing that the notification of the Board of Trade states: "It will probably be necessary for the Committees, from time to time, to ask for information, in the form of returns or otherwise, as to the distribution of the output, or portion of the output, of mines in their districts. Should serious objection be felt by coalowners to furnishing any particular information, the matter should be submitted at once to the Board of Trade, who will consult the Central Committee, if necessary." However, it is hoped the work of the District Committees will prove more effective than the measure of confidence we at present possess allows us to anticipate.

Wages and Man Output.

Meanwhile, the miners are again busying themselves over a further advance of wages. They lose nothing for want of asking. The Coal Conciliation Board for England and North Wales were last week considering an application for a 5 per cent. advance. On the new standard, the present rate of wages is 15 per cent., which is supplemented by a war bonus of 15½ per cent. The application is made on the ground that the market price of coal has continued to rise since the 5 per cent. advance was made last July. Owners, on the other hand, submit that the increased selling price is offset by the augmented cost of production. The consideration of the matter has been postponed until later in the month. Some interesting information was supplied by Lord Rhondda, at the recent meeting of the Consolidated Cambrian Collieries. He said that the output per man per day at all their collieries averaged about 4½ per cent. higher than in 1914, but was still some 5 per cent. below what it was prior to the operation of the Minimum Wage Act in the middle of 1912, and, of course, much below the output in times preceding the Eight Hours' Act and other restrictive legislation of recent years. The average earnings of colliers per day at all the collieries for the fifteen weeks ending Dec. 31 were 11s. 8·03d., and of all persons employed above and below ground, including boys, 8s. 11·72d. More than 12 per cent. of the men employed earned upwards of 16s. per day, or at the rate of £4 10s. per week, or (say) over £220 per annum on full time.

Extension of Women's Employment.

Almost every day one hears of some fresh direction in which women are taking on work previously done by men. In fact, on another page of this very issue it is stated that women have been engaged for the meter testing and repairing shop at the works of the South Suburban Gas Company; and they are found to efficiently perform the duties that are required of them. It is evident, however, that what is already being done is not enough—not nearly enough; for the Home Secretary and the President of the Board of Trade are desirous that prominence should be given to the fact that they are appealing to employers in the manufacturing industries to take concerted action for the purpose of making good the loss of labour caused by withdrawal of men for the Forces. While every confidence is expressed that the women of the country will respond to any call that may be made, it is pointed out in the appeal that the first step rests with the employers—to reorganize their work and to give the call. Therefore employers are urged to take two steps, if they have not already done so. First, to review the organization of their works, in order to ascertain how it is possible, by re-arrangement of work and other measures, profitably to employ, as temporary substitutes, as large a number of women workers as possible. Secondly, to send to the local Labour Exchange at once, and from time to time as the situation develops, particulars of their requirements for women labour, with the fullest possible details as to the classes of work, and the qualifications required. Emphasis is laid upon the undoubted fact that on the maintenance in the fullest vigour of the manufacturing industries of the country depend very largely the successful conclusion of the war and the continued prosperity of the nation in the years which will follow it. Employers will note that the Home Office and the Board of Trade are prepared to give them all the help in their power in maintaining output by taking on women. A strong Advisory Committee has already been appointed to help to give effect to the policy of the Government of extending the employment of women in industrial occupations; the Chairman being Mr. Cecil Harmsworth, M.P., and the Joint Secretaries Mr. F. Lavington, of the Board of Trade, and Mr. M. H. Whitelegge, of the Home Office. For the sake of the country, and for their own sakes, employers with suitable work will not allow the appeal to pass unheeded.

Municipal Motors.

That the use of motor vehicles in municipal service has been rapidly growing in popularity of recent times, must be abundantly evident to anyone in the habit of using the roads—and his eyes. But probably most people would be immensely surprised to learn the extent to which motors have now been adopted in this connection—as can be done by the study of a census which has been prepared at considerable pains by the "Municipal Journal." The information has been secured by application to municipal officers in all parts of the British Isles; and it is published in tabulated form. Remembering what an excellent fuel gas-coke is for tractors, there is considerable satisfaction to be gained from glancing through the tables. Motor-omnibuses, of course, largely swell the figures; but leaving these out of account, the number of motor vehicles in use is really remarkable, and they are for all kinds of purposes. In the case of Glasgow, for example, the total runs into three figures; the Gas Department alone being responsible for fourteen waggons, vans, and lorries. Summing up the compilation, our contemporary remarks that the question of whether steam, petrol, or electric vehicles should be adopted still remains open. While this is no doubt the case, the choice must be largely governed by the use to which the vehicle is to be put. It is admitted that steam-propelled vehicles have done, and continue to do, excellent work, often in conjunction with trailers. This is a point which, though already well known to the gas industry, it is pleasing to see published as widely as possible elsewhere. It is to be noted that many schemes for adopting motor-traction for one purpose or another are delayed or held over until after the war; and it should not be very long before there is a total absence of replies to inquiries, of the kind that were returned in a few instances on the present occasion—"My Council are not progressive enough for motors."

Coal and Coke Exports.

Bad weather and the extraordinary rates of freight have recently combined with the Coal Exports Committee to produce a lessening of the quantity of coal sent from our shores. The amount shipped in February was 3,086,695 tons, which was a reduction of 2,639,182 tons on the same month of 1914, and 542,795 tons less than was sent out of the country in February last year—3,629,490 tons. France is a better buyer than ever; and last month, with a purchase of 1,327,379 tons, it capped the figures for the pre-war February with 6612 tons, and February of last year with about 67,000 tons. A less amount is going to Italy and to most of the neutral countries. Foreign sales of coke are not doing badly. Last month 115,978 tons were exported; in February, 1915, 74,296 tons; and in February, 1914, 94,595 tons.

The economical utilization of peat in the generation of gaseous fuel, even without recovery of bye-products, is said to be to-day an accomplished fact. It can scarcely be doubted, says a writer in the "Journal of the Department of Agriculture for Ireland," that, with efficient chemical control, larger plant of sufficient capacity to deal rationally with the ammonia, tar, and other products of the destructive distillation of peat would lead to still greater economies.

PERSONAL.

At the close of the proceedings at the annual meeting of the Tonbridge Gas Company, the Chairman (Mr. W. Judd) announced that Mr. F. A. West, their Assistant Manager, had been appointed Manager of the Sittingbourne Gas-Works. He felt sure they would all join in congratulating Mr. West.

Mr. Hedley Hoy, the Gas and Water Manager to the Tyldesley-with-Shakerley Urban District Council, has been appointed Works Engineer and Manager to the Cannock, Hednesford, and District Gas Company, and will be taking up his new duties by the end of this month. It was at the end of 1912 that Mr. Hoy went to Tyldesley, previous to which time he was Assistant Gas Manager to the Lancaster Corporation.

Mr. James Gibson, Gas and Water Engineer to the Leigh Corporation, has been selected, out of 52 applicants, for the appointment of Gas and Water Engineer at Mansfield, at a salary of £500 per annum. Five candidates were interviewed by the Town Council—the choice finally falling upon Mr. Gibson. The newly-appointed Engineer, previous to going to Leigh, was Manager of the gas-works at Beverley, and prior to that Chief Assistant at Paisley. During his tenure of office at Leigh, a water-gas plant, a new holder, a sulphate plant, and vertical retorts have been installed. As Water Manager he has also had large experience.

On the 1st ult., Dr. J. J. Neurdenburg, the Director of the Utrecht Gas-Works, and one of the leaders of the Dutch gas industry, retired, on attaining 65 years of age. His direct connection with the industry dates from 1876, when he was appointed Inspector at the Leyden Gas-Works; four years later relinquishing the post to become Director of the Breda Gas-Works. At that time, he was elected a member of the Dutch Gas Association, and articles from his pen began to appear regularly in the pages of "Het Gas." He was one of the first gas men to take up the manufacture of sulphate of ammonia; and the knowledge he thus acquired was of great use to other managers when they came to adopt the process. In 1890, Dr. Neurdenburg went from Breda to Leyden as Manager, in consequence of the promotion of Heer Van der Horst to Utrecht; and in 1898, on the removal of that gentleman to Amsterdam, Dr. Neurdenburg succeeded him at Utrecht. He has held office in the Dutch Gas Association as Treasurer, as Secretary, and as Vice-Secretary; and his work for the industry has been acknowledged by his election as an honorary member. Dr. Neurdenburg is held in high esteem by gas men throughout Holland.

Alluding at the annual meeting of the Bristol Water-Works Company to the retirement [already announced in the "Journal"] of Mr. A. J. Alexander from the office of Secretary and General Manager, after 46 years' service, and his appointment to a seat on the Board, the Chairman (Mr. H. N. Abbot) remarked that Mr. Alexander's reign had been distinguished by energy, ability, and devotion to the interests of the Company, by courtesy invariably evinced, and by popularity in the city deservedly won. Besides this, Mr. Alexander had achieved a parliamentary reputation as an expert on the special legislation connected with water supply. He had been their pilot through eight successive parliamentary efforts, and eight Acts had been obtained, going from success to success. All through, Mr. Alexander had been the stand-by and the backbone of the Company; and they owed him a real debt of gratitude. Of late years, he had relaxed a little, and allowed his son (Mr. W. A. D. Alexander) to take up part of the work, so as to qualify himself as his successor. He (the Chairman) knew the proprietors would feel that the Board were only doing their duty in proposing to offer Mr. Alexander two-thirds of his salary as a pension, which would be £667; and also that they would approve of the Directors' action in offering him a seat on the Board. The proprietors having agreed to the proposals, Mr. Alexander, in returning thanks, said it had always been his good fortune to serve under Directors who had taken the greatest personal interest in all matters connected with the Company; and it was primarily to this fact that the undertaking owed its present prosperity.

Export of German Mantles and the Dutch Gas Industry.

Writing on the 26th ult., a Dutch correspondent mentioned that since Jan. 10 Germany has prohibited the export of incandescent gas-mantles of all kinds. It appears that the reason of this measure is to be found in the shortness of ramie yarn and also of cotton yarns. The German Government have taken stock of all the yarns left in the country—leaving to the different mantle factories only sufficient yarn to meet the supply of the local market. After the contracts with other countries have been fulfilled—and this will be very soon, as all contracts were of short duration, and the prohibition was quite unexpected—there will not be much chance of Holland getting incandescent mantles from Germany. For many Dutch mantle factories this is, however, a boon, as now the supply in Holland must depend upon the local factories, which are in a position to keep on working, seeing that they have for some time covered their supplies of raw materials from other countries. Furthermore, there can for the future be no fear, our correspondent concludes, that any mantles exported from Holland will be of German origin, "which ought to be a matter of satisfaction to the British gas industry."

OBITUARY.

The Board of the Plymouth and Stonehouse Gas Company has lost another of its members by the death of Mr. H. D. Bewes.

The death is announced, as having taken place on the 3rd inst., of Mr. William Barraclough, aged seventy-seven. In 1853 the deceased gentleman entered the service of Messrs. Newton, Chambers and Co., of Chapeltown, Sheffield, rising to the position of chief cashier twenty years later. Subsequently, Mr. Barraclough was appointed Secretary of the Company; but, owing to ill-health, he was compelled to retire in 1909.

The first President of the American Gas Institute, Mr. Benjamin W. Perkins, died on the 11th ult., at Hartford, Connecticut. He was, according to the "American Gaslight Journal," born in England, but went to the States when nine years old. His first connection with the gas industry was under his father, at South Bend, Indiana, where he eventually became Manager; then he served at Altoona for ten years, and in 1910 was made Manager of the Hartford City Gaslight Company. He was a member of the National Commercial Gas Association, the Michigan Gas Association, the Society of Gas Lighting, the New England Society of Gas Engineers, and the American Gas Institute. A contribution from his pen to the "American Gas Institute News" appears on a later page of to-day's issue of the "Journal."

Practical Lessons of the War.

There will still be in the minds of readers the paper read at the autumn meeting of the Society of British Gas Industries by Mr. R. J. Milbourne, of Newport (Salop), in which he dealt with the subject of the "War on British Trade"—a matter which members agreed it was of the highest importance should be properly considered. In his opening remarks, Mr. Milbourne drew attention to a series of articles at that time appearing in the "Engineer," in which, he said, it was very plainly stated that the Germans were already taking vigorous steps to retain, as far as was in their power to do so, their own foreign trade and trade connections, even during the war, and to baulk and jeopardize ours and that of our Allies. To the good work done in calling attention to a pressing matter on that occasion, Mr. Milbourne has now added by preparing of a pamphlet giving a *résumé* of the series of "Engineer" articles on "Lessons of the War," with an introduction which he concludes by saying: "Preparation for the future of British trade must be made now—the waiting till the war is over is suicidal. Germany is now fully prepared and ready; the day the war terminates will see that country set out on a war against British trade." The pamphlet has been specially prepared for the busy man—by whom, let us add, it may be profitably studied, for it is just to him that the warning message is addressed.

Munition Tribunals.

Under the Munitions of War (Amendment) Act, 1916, the Minister of Munitions is empowered to constitute special arbitration tribunals; and these have now been formed. There are two of these bodies, with Mr. Lynden Macassey, K.C., as Chairman of both. To one of them may be referred differences relating to the wages, hours, and conditions of employment of women or of semi-skilled and unskilled men; to the other, differences arising as to wages, hours, or conditions of employment of semi-skilled and unskilled men employed in a controlled establishment on munitions work of a class which before the war was customarily undertaken by skilled labour, and as to time-rates paid for the manufacture of complete shell and fuses and cartridge cases in a controlled establishment in which this manufacture was not customary before the war. As to the ordinary Munitions Tribunals, constituted under the Acts of 1915 and 1916, it may be stated that rules made in connection with the right of appeal from decisions of the Tribunals were published in last Friday's "London Gazette." Any person convicted of an offence, or against whom an order has been made, or to whom a leaving certificate has been refused, by a Munitions Tribunal (and in all cases the Minister of Munitions) may appeal against the decision to such Judge of the High Court as may be appointed for the purpose, on questions of law or of law and fact; and the other party to the proceedings before the Tribunal may, with the leave of the Judge, or with the written permission of the Chairman, appeal against the decision on grounds of a similar nature. The decision of the Judge on any appeal will be binding on all Munitions Tribunals in England and Wales; and there will be no appeal from it.

Scottish Junior Gas Association (Western District).—Members will pay a visit to the Kilmarnock Gas-Works next Saturday, and will see there the first installation in Scotland of Dempster's intermittent vertical retorts, as well as the Wilton tar dehydrating plant. Arrangements are being made to discuss at this meeting Mr. W. Bennett's paper on "Purification." The annual general meeting will take place in the Royal Technical College, Glasgow, on the 1st prox. The final lecture of the session will be delivered by Professor Arthur Smithells, F.R.S., of the Leeds University. The meeting will be followed by the annual social, when Professor Smithells will be the guest of the evening.

GAS INSTITUTION TRANSACTIONS.

A Comprehensive Index.

The volume of Transactions of the Institution of Gas Engineers for 1915 (produced under the editorship of the Secretary, Mr. Walter T. Dunn) has been received. We are pleased to see that the Council have adopted the suggestion made by the "Journal" to utilize the opportunity supplied by the meagre amount of material for the annual volume, by presenting the members with a comprehensive index covering the technical and other proceedings of the Institution, under its present and preceding titles, from 1863 down to last year. This has been done. Had it not been, the volume by its thinness would have borne testimony to the far-reaching effects of the war; now it does so by its unusual composition, and by the considerable value conferred by the index extending over fifty-three years, together with the twelve years' separate work of the former Institution of Gas Engineers—a very worthy achievement.

Of the 368 pages comprising the whole volume, no less than 182 pages are devoted to the life-index of the organization. The compiler is Mr. Norton H. Humphrys. We do not envy him the work that he has had to do; but he has this satisfaction, that the man who had the courage, the patience, and the perseverance to take up a laborious and intricate piece of work of this kind has placed the British gas profession under a lasting debt of gratitude to him. In this index, Mr. Humphrys has accomplished a piece of constructive work which, we hope, will have its great value enhanced by being kept up in future by (say) quinquennial or decennial supplements. There is no occasion to describe the plan adopted by Mr. Humphrys in making the compilation, as members will have already seen this for themselves. But the value of an index lies in its completeness—in producing something with an intelligent appreciation of the subject words under which other persons would look in seeking for the matter they require. Mr. Humphrys has worked with a view to a really comprehensive result; and several titles that we have tested have proved that they have been amply dealt with in respect of cross references. In one or two cases we might have chosen an alternative word to one or other of those preferred by the compiler; but it would be a little hypercritical to call particular attention to these instances, as they constitute quite a minor point, and one which after all is perhaps merely a matter of choice. We have pleasure in bearing testimony to the work having been well done, and to its intrinsic value being considerable.

As for the rest of the volume, the pages bear much the usual appearance, except for the absence of papers and discussions. Right in front, we have a "Roll of Honour"—those members who are with the Forces. There are upon it only 23 names out of a total membership of 870. This is a small proportion; but it only shows how the engineering and managerial staffs of gas-works have found that their services for the country are required at home. But this small number is no index to the total contribution made by the gas industry to the country's Forces. From the junior organizations and from the rank-and-file of the industry a large number of men have gone. As a frontispiece, there is an excellent reproduction of a photograph of the President (Mr. John Bond); and the volume contains his short Presidential Address—short to suit the one morning's sitting on June 1. The reports of Committees, the annual report of the Council and the accounts, the informal discussions at the meeting on matters arising out of the war and affecting the gas industry, are included. A substantial contribution to the volume is made by Mr. Ernest Scears with his abstracts of papers published in various chemical papers. These are prepared in a useful way, which makes them decidedly of practical use, and so adds to the technical value of the volume. The Benevolent Fund proceedings, the memoirs (honoured lives have retrospect here), lists of members, associate members, &c., and composition of Committees combine to make the book bear on first glance an aspect of normal completeness. Further investigation shows that first appearances are sometimes deceptive.

The "Captive Fire" System for Furnaces.

A lecture was delivered before an audience connected with the Leeds and Bradford Gas Departments on Monday evening last week, at Bradford, by Mr. W. R. Twigg, of the Davis Gas Stove Company, on "Gas-Fired Furnaces and the 'Captive Fire' System of Heating." The chair was occupied by Mr. J. H. Barraclough (the Chairman of the Bradford Gas Committee). In introducing his subject, Mr. Twigg explained the present necessity of the fullest use being made of gas heating, in the interests of national economy. He did not think there was a way in which national resources could be more importantly economized than by the greatly extended use of gas for industrial purposes. With this in view, he urged the giving of preferential treatment for the supply of gas for such purposes; and he complained that at present he found far too little disposition among makers of gas to realize the importance of this. The whole subject of the use of gas for industrial purposes was still in its early stages. Of this fact there was no better proof than was supplied by the variety of the methods now adopted. A report of what Mr. Twigg had to say will appear in a subsequent issue.

ELECTRICITY SUPPLY MEMORANDA.

As further reports of electricity supply companies are published, interesting features, associated with war conditions, here and there project themselves upon notice.

Interesting Features.

We have already mentioned points from the reports of the St. James' and Pall Mall, Westminster, and Chelsea Companies—features being that revenue and profit have fallen, and dividends naturally have followed suit. These unpleasant changes cannot be helped, owing to the higher costs for coals, wages, rates and taxes, and in other directions. But in some districts, there has been another cause operating. The lighting restrictions have meant a considerble falling-off in the sale of lighting units—the units which, through the price charged, bear the greatest financial burden—while, chiefly through war requirements, the low-priced power units have expanded considerably in output. We have an illustration of this from the Westminster Electric Supply Corporation, to whose accounts we referred a fortnight ago. While, in their case, the total output of units shows an increase, the revenue decrease is about £4080. This is due to the large addition—1,040,000—to the units sold for power and heating, while those sold for lighting purposes are less by 750,000. This of course, is not a comfortable position—the sale of an additional million of low-priced units, while three-quarters of a million of high-priced units less are sold, with all outgoings for material, labour, &c., considerably enhanced. In the case of the Kensington and Knightsbridge Company, the lighting restrictions, it is stated, have been the cause of the reduction of the units sold by 9 per cent., which entails a greater percentage reduction of net profit. The dividend in this case has been clipped down from 9 per cent. to 7 per cent. What the increase of coal and wages means is shown by the report of the London Electric Supply Corporation—the two items alone having risen from 0·5d. to 0·64d. per unit, and the total expenses of generation by some 50 per cent. The profit in 1913 amounted to £71,752; in 1914 the Company pleasantly surprised themselves by handling £93,234; but in 1915 the profit fell back to £77,687. A dividend of 4 per cent. was paid in 1914; but only 3 per cent. last year. The ordinary shareholders of the South Metropolitan Light and Power Company have, for one reason, cause to be mightily pleased with last year; for the gross revenue ascended by nearly £15,000 to £80,570, and the ordinary share proprietors, after a weary wait for a dividend, now obtain 4 per cent. The few holders of the Notting Hill Company's ordinary shares would be rolling in wealth if there were more of the shares. They are getting a dividend of 500 per cent.! But the total issue is only 27,050 shares of 1s. each; the whole of the remaining capital being in preference shares. This is a co-partnership concern; and the employee co-partners receive 8 per cent. bonus. The Newcastle and District Electric Light Company have an available balance of £30,582; but no dividend is being paid, although in 1914, with an available balance of upwards of £9000 less, 3 per cent. was paid, as against 4 per cent. in 1913. The absence of dividend is "in consequence of the abnormal conditions due to the war." We should have expected so.

Electric Pressure Testing.

Now we know why the Metropolitan Borough Councils owning electricity concerns desire that pressure-testing shall be discontinued. Mr. G. W. Keats lets the "cat out of the bag" in a letter to the "Electrical Times." He is in favour of the discontinuance of testing; and the reason is that, owing to the tug of the demand on the cables through war work, the pressure conditions are of a kind which the electricity undertakings are powerless to remedy. This being the case, we cannot see what all the bother is about. The London County Council will look charitably on any deficiencies under such circumstances; and they are not likely to take any action in the way of requiring undertakings, with a heavy war demand the pressure-depreciating cause, to improve matters. Mr. Keats urges in favour of discontinuance the "same reason that gas companies for war purposes have been allowed to vary their standard of quality." Gas companies fortunately have not varied their "standard" of quality in respect of calorific power but by a very small percentage, and what variation there has been is in regard to the luminosity of open flames, and not of the performance of the modern means of employing gas for illuminating purposes. Mr. Keats is mistaken as to gas undertakings having no restrictions placed on them as to pressure. Minimum pressures are prescribed in the Acts of all gas concerns. But, says Mr. Keats: "I know of instances where, I daresay, the pressure varies at times quite 50 per cent.; and it would appear to me that the interests of gas consumers have been neglected." This is rather a vague assertion. The "I daresay" shows that the statement is pure guesswork on the part of the author. Perhaps he will tell us, assuming a 50 per cent. variation in pressure in the street-mains, whether he thinks there would be a 50 per cent. variation in the efficiency of the tap controlled gas-using appliances.

Advertising Electric Cooking.

In connection with the electric cooking campaign, the electricians know how to advertise with the view to attract attention. They do so regardless of expense; and everything electrical is maintained in tip-top order by skilled folks. These are sides of the matter upon which the general public are not exactly enlightened. Here are a couple of instances. There has been an electric cooking and food exhibition at Selfridge's. In the model kitchen, there have been demonstrations of the preparation of bread, cake, pastries, and other dishes; and the "dainty products" of the electric-cookers have been handed round to the public to taste. The electric appliances employed left nothing to chance in regard to heat. The type of domestic oven used could be loaded to 3 KW., the grill was rated at 1·4 KW., two boiling-discs took 1·2 KW., and the third 0·8 KW.—the oven and discs being arranged for three-heat control. The roasting-oven could be loaded to 7 KW.; and in this bread and poultry were baked. Running over to Golders Green, the Company of Electric Caterers (whoever these worthies are) have started, opposite the Tube Station, an "all-electric" restaurant. It is known as the "Refectory;" and it is stated that the list of such places is growing. The building has striking architectural and decorative features, so we learn from the "Electrical Times." On the ground floor the foyer is furnished in the Jacobean style, with refectory tables, oak stools, pewter plates, and so forth. The ground floor lounge is equipped with "Dryad" cane tables and chairs and Oriental rugs; while downstairs the furnishing scheme in the luncheon and supper room comprises oak tables and rush seat chairs. It forms, the report runs, a cosy place for luncheon, tea, or dinner, to say nothing of supper after a visit to a theatre in town. The windows are filled with cakes and sweets, prepared electrically on the premises. Meals, "cooked to perfection" in the electric kitchen, are served in dainty surroundings by equally dainty waitresses, whose dark brown dresses with art trimming harmonize with the decorative scheme. It is understood (whether this was transmitted by wireless or otherwise is not stated) that on the opening day the "Refectory" was visited by upwards of 2000 persons. Did they all have a meal? However, it is clear that electric cooking requires a lot of advertising and demonstrations to place the "merits," but not the disadvantages, of electrical operation before a doubting public. Conviction as to the merits does not accrue at a rapid rate.

Zeppelins and Electric Lighting. "Electrical Engineering" thinks it is very wrong when Zeppelins are menacing to shut off the supply of electric current at generating stations. Our contemporary has before thought so, and said so; but the rulers of some of our important cities and towns do not appear at all impressed by the opinion. They have their own views, and their own methods as to the way of doing things, in these days, when a vain-glorious military power thinks one way of conducting war is to drop from above after dark high-explosive and incendiary bombs into peaceful homes, and so kill defenceless children, women, and men. These are uncomfortable happenings; and one of the best means of protection that can be applied against these cowards and fiends, some local governing bodies opine, is the total extinction of light. This is all very well in streets and other open public places; but really there cannot be any necessity for it inside dwelling-houses and other premises with well-screened windows. We referred last week to the proposed total extinction of the electric light at Manchester on hearing of the approach of Zeppelins, but with five or ten minutes' preparatory warning by jumping the voltage up and down. Even so, our contemporary raises the objection that to plunge suddenly into absolute darkness the streets of a city full of traffic would be in itself sufficient to produce more casualties than any to be anticipated from dropping bombs. So far as the streets are concerned, we would rather risk the dangers of darkness than be in the neighbourhood of a bomb. Such an instrument of destruction does not give one time to exercise common precautions regarding self-preservation; while in dark streets care can be taken to avoid danger. Moreover, people in electrically lighted areas are not unaccustomed to sudden extinctions of the light. We sympathize more with the suggestion that there ought not to be sudden shutting-off of the lights in theatres, music halls, &c., and particularly in hospitals. In the former, because of the risks of panic; in the latter, because of the danger to life. Our contemporary realizes that the extinction of the light in an operating theatre might result in the death of a patient. Of course, the fewer collapses of light the better; but even in theatres, music halls, and hospitals, such occurrences are not unknown where the electric light is used. It is submitted, too, that the sudden stoppage of works would introduce another risk.

To Destroy a Destroyer. Our contemporary does not protest without suggesting an alternative. Its scheme is quite a simple one, and easy of application. A Zeppelin, it says, of upwards of 400 feet in length, should be fairly easy prey for a small fleet of aeroplanes—if they can see a thing 400 feet long, and if they have sufficient light to rise in safety. Searchlights with a concentrated beam for the former purpose, and a diffused beam for the latter, should be used. Aeroplanes should rise from well-lighted aerodromes inland as soon as the warning of the approach of Zeppelins is received from the coast. The aeroplanes would then proceed to the places which the Zeppelins will make their main objectives, and near which lines or rings of searchlights of long range and high penetrative power have been erected. Of course, this presupposes the Zeppelins have informed the aeroplanes of their objectives. When the Zeppelins appear, the aeroplanes from the inland aerodromes will rise above them, and "good-bye" to the raiders. Of course, if the searchlights have insufficient power, they will act as beacons for the enemy, and yet not illuminate the hostile air craft sufficiently for efficient attack. But the avoidance of this risk is merely a question of mirror diameter and amperes. Our contemporary winds up by saying: "If the War Office need guidance on these points, we shall be happy to give it." The War Office ought to be very grateful over this offer; but we have our misgivings.

The Testing and Rating of Lamps. With the different methods of installing filaments in incandescent electric-lamps, the old plan of taking the measurement of the illuminating value on the horizontal plane can no longer be justified, if the newer lamps are to be credited with their maximum light-giving power. The horizontal system was all very well in the days of the carbon, tantalum, and normal tungsten lamp; but with the advent of spirally wound filaments and half-watt lamps, new conditions set in, which, to give the lamps their full due in light-giving power, demanded a different system of testing. Hemispherical candle power has its attraction, in that light is generally required in a downward direction; but for lamps one uses indoors, where there is top reflecting power, the mean spherical candle power seems to be the proper thing, though its measurement is an awful nuisance. But here again there are difficulties. The makers of incandescent electric lamps do not appear to want to relinquish the test that will give the maximum candle power to any type of lamp—that is, if candle power rating is retained. We see this from an article by Dr. Ernst Salomon in the "Electrotechnische Zeitschrift." He writes: "If we change from the horizontal or hemispherical candle power to the spherical candle power, we should have to reduce by 20 per cent. the candle power of carbon lamps and of tungsten lamps of the old normal type. Spiral lamps have been rated by some makers on the basis of mean spherical candle power; but the candle powers of other lamps would require to be nominally reduced by 20 per cent. Thus, instead of the ordinary 16-candle power, we should have to talk of a 13-candle power lamp, and so on. Half-watt lamps would require to be altered in their ratings, in so far as they have hitherto been sold on the basis of hemispherical candle power. Their nominal candle powers would probably have to be reduced by 25 per cent." The upshot of consideration of these matters is that the lamp-makers in Germany have come to the conclusion that lamp ratings should be in watts—in other words, they prefer to tell the consumers the input of current, but they do not want to inform them as to the product in light. For instance, a consumer who bought a 100-watt (so-called) half-watt lamp would be able to get approximately 140-candle power from it; with an ordinary metallic filament lamp, only about 60-candle power would be realized from the 100 watts. Thus, from the consumer's point of view a rating in watts is meaningless so far as illumination output is concerned.

The Variability of Electric Lamps. In the course of his argument in favour of wattage rating, Dr. Salomon advances as one reason that many of the quantities referring to the work of electric lamps are variable and difficult to guarantee, under the conditions of use. As a matter of fact, he says a lamp ought to be defined by the following facts relating to it: Its voltage, its current, the watts consumed, the candle power, the watts per candle power, its absolute length of life, as contrasted with its useful life (which is usually defined as the length of time taken for the candle power to fall 20 per cent.), the changes that take place during its life in the watts consumed and the changes in watts per candle power. Many of these quantities are interdependent and a few must be omitted, in spite of their importance, when it comes to a question of marking them on the lamp. A lamp would be an interesting production with all this data upon it. Regarding the variability and difficulty of guaranteeing the lamps, Dr. Salomon says that each manufacturer must use his own discretion as to making statements about length of life and decrease of candle power, having regard to fluctuations of voltage on the mains and many other difficult factors. It ought, of course, to be sufficient to state the voltage, the candle power, and the watts consumed; but the German makers, like the American, prefer the safe refuge of watts, and watts only.

Large Compressing Plant at Cardiff.

The Cardiff Gas Company, who, over a number of years, have had very considerable experience with Keith compressors (having had in use three gas-engine driven machines, each capable of dealing with 20,000 cubic feet of gas an hour), have demonstrated their satisfaction with the system in the most practical manner. The Company have now given to the James Keith and Blackman Company, Limited, an order for a much larger compressing plant, which is intended to deal with a maximum of 100,000 cubic feet of gas per hour, at pressures ranging from 50 to 100 inches water column. To meet these requirements, the Keith-Blackman Company will supply two of their "G" size rotary gas-compressors, geared to suitable gas-engines; each unit being capable of compressing 50,000 cubic feet of gas per hour. The plant will be used for boosting purposes; and at the same time connections will be taken off the mains at any necessary points for the supply of gas to high-pressure lamps, with which the Cardiff Gas Company have been doing an extensive business.

FUEL ECONOMISTS.

By W. J. A. Butterfield, F.I.C., Assoc.Inst.C.E.

The paper on "Economy of Fuel" which Professor W. A. Bone, F.R.S., read before the London Section of the Society of Chemical Industry on Monday last week, has again drawn the attention of technical chemists to a matter which has always been uppermost in the minds of the more thoughtful of them.

It is greatly to be hoped that the paper will serve the purpose of influencing the public, and the industrial community in particular, to revise the methods by which they now consume, and more or less incompletely utilize, fuel, and impel them to seek technical advice as to how improvement can be effected in their present practices. A Committee exists, under the chairmanship of Professor Bone, having among its objects the study of the supply of coal, the use to which it is at present put, and methods by which better utilization of coal might be achieved. Unfortunately, the efforts of the best committees of inquiry in this country are commonly nullified through the indifference of the general public, who will not study lengthy blue books or official reports. Individual effort must supplement the work of any such committee, if the general public is to be influenced otherwise than by the all-compelling force of ever-increasing drafts on the pocket. Gas undertakings should be, and for the most part are, in the foreground in stimulating economy of fuel throughout the country. By economy in this sense the writer means, not so much a parsimonious avoidance of the use of fuel, but efficiency in its use. Electricity supply undertakings which have modern plant likewise fall, with many other users, under the censure of theoretical fuel economists.

The views of the academical fuel economist were well displayed in the paper which Professor H. E. Armstrong read on Feb. 16 last before the Newcastle Section of the Society under the lengthy title: "The Problems of Coal with Reference to the Complete and Provident Utilization of the Supplies and of Fuels Generally: Preliminary Discussion and Scheme" [*ante*, p. 413]. Since the two papers were presented to the same Society, though read before different sections, it would have been interesting if Professor Armstrong's paper had been open for discussion at the same time as Professor Bone's. The writer had the opportunity of making a few observations in the discussion on Professor Bone's paper, which will, he hopes, in due course be printed, with some amplification, in the Society's Journal; but there are a number of points raised by the two papers which are of particular interest to gas engineers, and could not opportunely have been dealt with in the discussion on Professor Bone's paper. The Editor of the "Journal" has asked the writer to draw attention to a few points arising out of the two papers and the general question of the economy of fuel.

Raw Coal and Soft Coke as Domestic Fuels.

Professor Armstrong would urge the Society of Chemical Industry to advocate an enactment forbidding the use of raw coal for domestic purposes—such enactment to come into force at the latest ten years hence. He does not believe that gas coke, as now made, can ever be a satisfactory domestic fuel. Hence he is asking the public to deprive itself of the right to burn coal for domestic heating while he disbelieves that the only practical alternative in the way of solid fuel now obtainable will give satisfaction. If he had intended to suggest that the proposed enactment would in effect make gas the sole domestic fuel, gas engineers might possibly have been gratified by his proposal. It is evident, however, from his paper, that he wishes the country to prohibit the use of raw coal as a domestic fuel ten years hence on the strength of his assurance that in the meantime the production of an acceptable soft coke of the "Coalite" type will have been successfully established on an economical manufacturing basis. Much may be done by Act of Parliament in compelling the public to accept novelties and put up with inconveniences of the benefit of which, to themselves or the country, they are profoundly sceptical. The last eighteen months have afforded many instances of the submissiveness to authority even of the freeborn Briton when his common sense teaches him that, in prevailing conditions, protest would be less useful than compliance; and this despite his deep and growing mistrust of authority constituted of an assemblage of mere politicians, lacking in true knowledge, good judgment, and business ability. But even the newly-engendered tractability of our countrymen would not bear the strain which the enactment proposed by Professor Armstrong would put upon it. The theorists who are foremost in condemning the public for the abuse of coal as a fuel which undoubtedly occurs, forget the substantial advantages which it presents to domestic users, in particular, over any other form of solid fuel. Gas undertakings have had an uphill fight to convince the public that gas coke is deserving of patronage, and gas coke has a distinct superiority over low-temperature coke in its greater hardness and density, which admit of it being roughly handled in transport. Low-temperature coke appeals to a certain class of well-to-do consumers, who like the pleasant glow of the fire which it affords, and are gratified by the impression that in using it they are displaying their superiority to other people. To this class of users it will always appeal; but it is very doubtful if any very large proportion of the public will accept it as a substitute for coal for general domestic use. If it could be supplied at a sensibly lower cost per ton than coal, the ordinary consumer would be tempted to adopt it. It is, however, no use shutting one's eyes to the fact that coal is a much more concentrated form of fuel than low-temperature coke, and that, generally speaking, it will cost more to convey a ton of the latter (or a given number of heat units contained in it) from the place of production to the consumer's cellar than a ton of coal (or the quantity of coal which contains the given number of heat units), that his cellar will hold only one-half or five-eighths the quantity of low-temperature coke that it will of coal, that scuttles will need filling twice as often, and that fires will need making up nearly double the number of times in the day. The householder's efforts at the present day are largely directed towards reducing labour in the household, and there can be no question that low-temperature coke gives more work in the house than coal, except that chimneys need sweeping somewhat less often. As a luxurious domestic fuel, low-temperature coke will continue to find many advocates and users, but its advantages will not outweigh its disadvantages with the majority of small householders. Domestic fuel economy must be achieved in other ways—viz., by a greatly more extended use of gas, by the adoption of more efficient types of coal fires and ranges, and by the partial substitution of gas coke for coal.

Coke Briquettes.

There is another form of solid fuel which combines most of the advantages claimed for low-temperature coke with greater density and ease of handling. This form is coke-breeze briquettes, the production of which at the present time would help to dispose of the surplus stocks of pitch. These briquettes, when made with the proper proportion of pitch from coke-breeze which has not an excessive content of ash, form a fuel which has advantages in respect of cleanliness over coal, and in respect of density and ease of handling over coke. They ignite more readily than gas coke, and give a fire which is at least as pleasant as that given by low-temperature coke. The writer thinks it not improbable that, in the near future, even a certain proportion of large coke will be crushed for the purpose of producing coke briquettes. It is a pertinent fact that the amount of pitch produced from gas-tar is rather more than would be required to briquette the whole of the breeze and coke not consumed on the gas-works itself. Economically, it would appear sounder policy to use this pitch on the local gas-works in producing a good domestic fuel from gas coke, than to transport the pitch many miles in order to use it in the briquetting of anthracite. Low-temperature coke, on the other hand, would be less suitable than gas coke for briquetting in this way. It retains a considerable proportion of the volatile matter of the coal, and the addition of pitch in order to briquette it would convert it into a fuel having no advantage in respect of smokelessness over coal. Nevertheless, since low-temperature coke yields in handling a large proportion of breeze, it may well prove desirable, wherever such coke is manufactured, to adopt means for briquetting the breeze, using as little pitch as need be as binding material, or even a non-bituminous binder.

"Waste" of Raw Coal for Power Purposes.

Passing from domestic economy of fuel to the question of economy in the use of coal for other than household purposes, it is noteworthy that, according to Mr. G. T. Beilby, quoted by Professor Bone, of the total coal used in this country rather less than 20 per cent. is used in the iron, steel, metallurgical, and ceramic industries, rather less than 10 per cent. on railways and in the coasting trade, somewhat over 40 per cent. in mines and factories, and about 10 per cent. on gas-works. Adopting another mode of classification, it is estimated that 30 per cent. of the coal used in the country is used for power purposes, and 20 per cent. is coked either in ovens or on gas-works. As to the consumption for power purposes, undoubtedly there is room for considerable economy; but the opinions of technical men as to the best way of effecting such economy will be very different from those of the academical theorists. It has been proposed time after time by some of the latter that all coal should be gasified before it is used for the production of power; the general argument being that in the consumption of raw coal in furnaces its valuable bituminous and nitrogenous constituents are entirely wasted. It must be borne in mind, however, that the term "waste" when thus applied has a relative and not an absolute meaning, and that "waste" in one direction may be more than counterbalanced by consequent saving in some other direction. If it is necessary, in order to recover certain constituents or products of raw coal, to spend more than their value on plant, labour, and material, it is obviously more wasteful of the resources of the country to effect their recovery than not.

Real waste in the consumption of coal for power purposes—due to the retention of furnaces, boilers, engines, &c., of low efficiency—will most naturally be condemned in the strongest terms by all. There is no room for difference of opinion on this score; and much influential support could be found for a proposal empowering the State to require power users to replace plant which entails an excessive consumption of coal or energy by more efficient plant. This is, however, a very different proposal from that of the theorists who would debar power stations from the direct consumption of raw coal. It is well to consider what alternatives these theorists can offer, and how they compare in respect of economy with the most up-to-date methods of directly consuming raw coal for the production of power.

A modern power station consumes raw coal in boiler-furnaces in such a way that at least 65 per cent. of the heating value of the coal is utilized in the production of steam. A considerably higher proportion is often guaranteed and obtained. With high superheat the consumption of steam per kilowatt-hour may be as low as 11·8 lbs., which is the figure achieved by a very large installation in Philadelphia. This means that, in an up-to-date power installation, it should be possible at the best load to consume only about 1·15 lbs. of coal per kilowatt-hour. Actually such a result is not at present attained in ordinary working in any power station in this country. But there is no question that it is well within course of attainment; and no alternative to the present practice of generating current for power purposes by means of highly superheated steam and turbines is likely to be considered by the engineering advisers of power undertakings unless it can show a better utilization of the calorific power of the coal consumed.

(*To be continued.*)

TECHNICS OF FIXING GEYSERS.

By Thomas Newton, of Hereford.

The modern gas-geyser is a highly-efficient water heater which has hitherto been somewhat under-estimated; and in view of the universal and insistent demand for a cheap and ready method of obtaining unlimited supplies of hot water, it is surprising that the possibilities of the geyser have not yet been more fully realized and more keenly appreciated.

As a compact and self-contained apparatus, a geyser is capable of fulfilling the requirements of a bathroom, lavatory, or scullery; and if due regard be paid to the fixing, it would prove a veritable boon to many households. It is essentially a labour-saving contrivance; consequently, its claims are entitled to more favourable consideration than has hitherto been meted out to it. Viewed from the standpoint of a gas undertaking, as a commercial proposition, the recommendation of geysers is worthy of more than passing attention; but from the domestic point of view (particularly in these servant-problem days), a demand is already present which only needs to be intelligently dealt with. Where a hot-water circulating system is in existence, in connection with which a gas-heated circulator can be successfully installed, it is, of course, more practicable to fix one of the many efficient types of gas-heated circulators now on the market in preference to a geyser. But there are thousands of houses which cannot boast of a hot-water circulating system—good, bad, or indifferent; and in each of these cases a geyser is the one thing needful, if not the one thing indispensable.

To heat a bath of from 25 to 30 gallons of water with about 30 cubic feet of gas (a result which can readily be obtained by using a geyser) is too patent an advertisement to be lost sight of in these days. A penny a bath would be shouted from the house-tops by our electrical friends if this result could, by some turn of the magician's wand, be brought within the scope of their practical experience. It will be seen, therefore, a potent argument is thus placed at the disposal of the gas industry; and it almost goes without saying that no avoidable delay should be incurred before reaping the full benefit of this desirable business.

Some amount of discrimination is necessary as regards the type of geyser to be recommended for a particular purpose. For example, while an "open" type can confidently be recommended for bath purposes, only a "sealed" type is permissible for general domestic use, where the hot water may be occasionally required for drinking, and also for culinary operations.

Geysers made of copper are superior as regards durability and conductivity to those made of other metals; but the interior surfaces—*i.e.*, those that come into contact with the water—should always be tinned before the geysers are constructed.

In selecting a geyser, it is more economical—particularly as regards the ultimate gas consumption—to choose a large one rather than a small one. Moreover, by so doing, expectations as regards results are seldom falsified. For the protection and preservation of a sealed geyser, an inter-locking gas and water tap, a dual valve, or some other similar arrangement is essential. It is sufficient if an "open type" geyser has an interlocking pilot light. Luminous jet burners are preferable to a bunsen ring-burner, inasmuch as they obviate the possibility of any lighting-back at an air-chamber, which contingency sometimes arises with the latter type of burner.

When fixing a geyser (unless there are overwhelming reasons to the contrary) it should be placed at the foot of the bath. In this position the geyser is always in sight of the occupant of the bath. Moreover, the foot of the bath is usually situated against, or near to, an outside wall; consequently, the products of combustion can readily be conducted through it without an unnecessary amount of flue-pipe, in the event of this method of getting rid of the fumes being adopted. Further, the cold water supply is generally more available at the foot of the bath.

The geyser should be fixed with its base level with the top of the bath, or as near to it as circumstances will allow, and in such a position that the delivery spout projects well over the bath. Whether a bracket or stand is used, depends on whether the bath is fixed close to the wall or some distance from it. In the former case, a bracket, of course, will be selected; but in the latter contingency, a stand will be preferable. But in any case, the geyser should be firmly fixed on the bracket or stand (as the case may be), and this should be securely screwed in position to render it perfectly rigid.

A flue-pipe of adequate diameter is of paramount importance in connection with a geyser; and under no pretence whatever should a geyser be fixed without one. The flue-pipe should be equal in diameter to that of the flue outlet of the geyser, and it should be continued undiminished throughout its entire length. It is always better to arrange the flue to rise vertically for as great a distance as possible. If a chimney breast is in the immediate vicinity, it is a good plan to utilize it, in which case a baffler would be fixed on the flue-pipe, and a bend on the baffler (near the ceiling) to conduct the products of combustion away to the chimney. However, a chimney is not always available; so an alternative method would be to conduct the fumes along a pipe leading through the outside wall, such pipe to terminate in (1) a tee having a conical top and an open bottom, (2) an open-ended H-piece, (3) a Ewart's ventilating brick. The latter is very effective, and can be highly recommended, more particularly in cases where an outside pipe would be considered a disfigurement to the wall which happened to constitute part of the bathroom. It is permissible, though not always advisable, to terminate the flue-pipe with a cowl in the roof. But the roof must be well ventilated, even though it necessitates the fixing of one or more ventilating bricks to accomplish this. Whenever this method of disposing of the products of combustion is adopted, great care should be exercised in guarding against the possibility of the hot fumes coming in contact with adjacent roof timber. It should also be borne in mind that low roofs are altogether unsuitable for the adoption of the method under consideration.

It is a mistake to conduct the flue-pipe through the outside wall immediately above the geyser outlet, since this tends to produce a down-draught by sheer syphonic action. The presence of a baffler would certainly prevent the flames being extinguished; but the net result, in nine cases out of ten, would be equivalent to the geyser being fixed without a flue-pipe—particularly in a low-lying district. One remedy for this would be to continue the flue-pipe vertically outside the building, and thus compensate for the original error inside. But this is bad practice, and should be avoided. It is always advisable to obtain as much vertical rise as possible inside the building.

The flue-pipe should be firmly fixed to the wall by means of neat clips of strap iron screwed to chamfered rectangular wooden blocks about ¾-inch thick, which have previously been nailed in position. A flue-pipe which is temporarily fixed, and thus capable of being easily dislodged, is a source of danger, and little better than no flue-pipe at all.

The cold water supply to the geyser should be arranged to give a sight-feed (excepting the type which is provided with a dual valve); and as regards this latter, the water supply only needs connecting to its respective union joint. Whether the geyser be fixed in the bathroom or in the scullery, a water supply is invariably near at hand, in which case the geyser supply may be branched into the existing supply. But wiped joints should be insisted on for all water-pipe connections.

A condensation pipe is required for a sealed geyser, and ⅜-inch copper tubing will be suitable in every respect. This should be connected to the union provided for the purpose, and then conducted and jointed into the bath waste-pipe, or, alternatively, conducted through the outside wall and into a spout head, if there be one available. Supposing the geyser to be fixed in the scullery, it will be sufficient to conduct the condensation pipe outside to the nearest gully.

The gas supply to a geyser is all-important, and inadequacy in this respect spells inefficiency, failure, and disappointment. Where any doubt exists, it is infinitely better to err on the large, instead of on the small, side. To obtain satisfactory results from a small geyser—one (say) capable of raising water to bath temperature at the rate of 2 gallons per minute—the gas-pipe should be sufficiently large to supply gas to it at the rate of 120 cubic feet per hour. Some consumers when they see (what to them is) a comparatively large gas-pipe being laid, erroneously suppose that it is being done simply to encourage them to waste gas. It is always better to remove this false impression at once by tactfully explaining that the precise opposite is the fact, since an adequate gas supply means quick and efficient service without the waste and loss which would otherwise occur through unnecessary and prolonged radiation.

An independent gas supply direct from the meter is essential in all cases—the size of the pipe varying, of course, in accordance with the size of the geyser. For a geyser rated at 2 gallons per minute, a ⅝-inch pipe is the smallest that should be used; and if the distance from the geyser to the meter exceeds 30 feet, the remainder should be at least ¾ inch. Similarly, a geyser rated at 3 gallons per minute would require the next larger sizes of piping. Where iron piping is used, nothing less than ¾-inch should be entertained.

In conclusion, the installation of a geyser oftentimes involves the installation of a larger meter in order to obtain the best results, since it is manifestly impracticable to fix a geyser properly and then leave the flow of gas, in the slightest degree, restricted at the meter.

THE EVOLUTION OF THE MODERN CHARGING AND DISCHARGING MACHINE.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

[*Continued from p.* 531.]

The following are the points of design to which, to the author's way of thinking, the designer of these machines may turn his attention, with a view to attaining a reasonable degree of standardization (referred to last week), at no sacrifice in efficiency and no appreciable increase in first cost.

(1) In some cases the ratings of the travelling and the stoking motors respectively are very much the same, and interchangeable machines, both mechanically and electrically, may be advantageously employed.

(2) Where the design of the machine is such as to necessitate the employment of different sizes of motors for the above duty, these motors may be of the same type; and certain of their parts—such as the brush holders and brushes—may be interchangeable.

(3) The difference between the respective ratings of the above-mentioned motors is rarely so wide as to prohibit the use of identical controllers, whereby the stocking of two types of controller spares may be avoided.

(4) The question of the use of identical controllers for all three motors is well worth consideration; but the cost may be prohibitive where the hoisting-lowering motor is a small machine.

(5) The resistances used in connection with the three respective controllers will vary with the capacity of the individual motors; but there is no reason why the three resistance frames should not be built-up of the same type of unit.

(6) It is the custom of many makers to protect all three motors by the use of automatic circuit-breakers or fuses (or both) on each motor circuit; and there is no reason why the circuit-breakers and fuse boxes should not be identical in all three cases—the setting of the breaker or the rating of the fuse only being varied to suit the conditions of working.

Two *versus* Three Motors.

While the use of a separate motor for each individual motion is an ideal arrangement, and has led to the employment of an increasing number of three and four motor machines, it may be remarked that the three and four motor stoker is by no means the improvement on the two-motor machine as that machine was on the older single-motor stoking machine. The real step towards efficient and rapid working was taken, in the author's opinion, when a separate motor was fitted to the two motions of the machine which are most constantly in use—viz., the charging-discharging and the travelling motion. In this connection, it may be observed that, in speaking of the charging-discharging motion, the writer has in his mind the type of machine in which the same fire element and the same motion serves for the dual operations of charging and discharging. These motions, from their frequent use, call for a very high degree of efficiency; and, apart from all other considerations, their operation by separate motors is justified by the saving of which this practice permits in regard to power supplied to the machine and converted into mechanical form without the losses which are inseparable from the use of gearing.

So far as the raising and lowering motion is concerned, there is by no means so strong a case for the employment of a separate motor for this purpose. Compared to the constant operation of the stoking and travelling gear, the raising and lowering motion is but infrequently used; and the effect of its commercially inefficient operation on the power costs is practically negligible. The considerations which lead to the use of a separate motor for this purpose are of a purely technical character; and in some machines this gear can be clutch-driven from one of the other motions without introducing any element of inefficiency or mechanical complication in regard to either that motion or the motion with which it is interconnected.

This is particularly the case in the following machines:

1.—The Fiddes-Aldridge two-motor machine, in which the raising and lowering gear is interconnected with the charging-discharging gear on the inner frame.

2.—In the De Brouwer machines, in which (in the charging, the discharging, and the combined stoker types) the raising and lowering gear is interconnected with the travelling motor gear-box fitted on the sill-plate of the machine.

3.—In the West machine, in which the raising and lowering gear is interconnected with the travelling motor.

4.—In the Toogood (R. Dempster and Son) machine, in which the raising-lowering and the travelling motion are controlled by the same motor.

When we consider the relative intermittency of operation of the raising and lowering gear as compared to the other motions of the machine, it becomes apparent that, so far as capacity and ease of handling are concerned, there is little to choose between the three or four motor machine and the machine in which the raising-lowering gear is interconnected with one of the other motions. In the plant under the writer's charge, the first machine installed was a single-motor simultaneous type built by Messrs. Aldridge and Ranken. In the latter part of 1913, a second Fiddes-Aldridge machine was put to work; and while this machine followed the lines of standard practice, it was fitted with a separate motor for the travelling motion, fitted on the near sill-plate and driving the travelling shafts by means of worm-reduction gear.

This new machine has a capacity of 20 to 25 per cent. over the older single-motor machines of the same general type; the increased capacity being entirely due to the ease of operation which the two-motor control affords and the rapidity with which the change from stoking to travelling gear can be effected, thus enabling the machine to take up and quit its position in front of a retort in the minimum time. A master controller is used; the change from one motion to another being effected by a change-over switch. This modification is a decided success in every way, and results in greatly diminished maintenance charges; but the writer has no hesitation in stating that the capacity of this particular type of machine would not in any way be increased by the employment of a separate motor for the raising and lowering motions, while it is very doubtful whether any technical advantages would accrue from such an alteration.

A rather interesting fact is that the conversion of a standard single motor "F.A." machine to this newer type can readily be effected; and such an alteration is well worth the consideration of any engineer who finds the capacity of his existing machine taxed to its utmost—say, by retort-house extensions—and who is not in a position to consider the immediate purchase of a second machine. The machine alluded to was the first of its kind, and was built to the design of the author, so far as the travelling gear was concerned; and in order to avoid disappointment a liberally rated travelling motor was installed. This rating permitted the use of a change-over switch in conjunction with the standard controller and resistances; but experience has shown that in future machines the cost of this alteration can be considerably lessened by the use of a smaller motor and a separate controller and resistance. A safety device can be fitted to ensure that the machine cannot travel while the fire element is in the retort.

Safety Devices.

To protect the motors against injury due to the passage of an abnormal current, it is customary to fit a circuit-opening device, which comes into operation when the current in the circuit in which it is connected exceeds a predetermined limit. The device may consist of the ordinary fuse-box or the instantaneous type of magnetically operated circuit-breaker. The latter apparatus will afford the greatest amount of protection if maintained in proper condition of efficiency, and particularly in the event of a hang-up occurring in any part of the gear and suddenly checking the speed of the motor. Under such conditions a heavy current is bound to flow through the motor windings, and a very heavy resultant torque will be exerted which may easily cause considerable mechanical damage in the short time that must elapse between the increase of the current and the melting of the fuse.

The fuse is a circuit-breaker with a time limit, and cannot open a circuit synchronously with the occurrence of an overload; while the automatic circuit-breaker will operate the instant the current exceeds the figure at which it has been set. For this reason the fuse-box alone cannot be regarded as affording the maximum degree of protection; and the automatic circuit-breaker is becoming a standard fitting with these machines. Some makers not only fit a separate circuit-breaker on each motor, but supplement the breaker by a fuse-box in series with it; so that if for any reason the breaker should "stick," the motor is still protected by the fuse. The maximum degree of protection which this arrangement affords quite justifies the slight (comparative) extra expense which such an arrangement entails.

The function of the fuse-box and circuit-breaker is not so fully realized as it should be by many users of these machines, who, in a thoughtless manner, are too prone to share the view of the average operator—namely, that the fuse or circuit-breaker is just a troublesome device which, by opening at the very moment when it should keep in, interrupts the stoking operations; and engineers who would "fire" a man straight away for hanging a brick on a boiler safety-valve lever are quite unmoved at the sight of an operator holding, or tying, his circuit-breaker in, or increasing the strength of his fuse without any reference to the electrician in charge. The fuse and the circuit-breaker, either singly or in combination, protect not only the motor and its control gear, but (what is even more important) the gearing of the motion to which the motor is connected. Unless means are taken to limit the enormous torque which is the chief characteristic of the series-wound motor, great damage may result to the gearing in the event of a hang-up. It is a significant fact that it is not the motor which suffers most, but the gearing, unless means are provided for automatically shutting-off the current at such times.

Electrical safety devices are also employed for the following purposes:

1.—To ensure that the suspended frame cannot be raised or lowered beyond the safe maximum limits.
2.—To ensure that the machine cannot be travelled while the stoking element is in the retort.
3.—To ensure that the stoking element or elements cannot be driven too far forward or brought back into the machine beyond the "home" position.

The latter device is certainly a wise safeguard against a costly accident due to a momentary lapse on the part of an operator; but so far as (1) or (2) is concerned, it seems at first sight difficult to imagine a sober operator handling his equipment in such a manner as to render these devices operative. Experience has shown, however, that these devices, extreme though they may seem, are essential to guard against the failure of the human element; and only last Christmas a serious state of affairs was caused on a provincial gas undertaking by a machine of this class being badly damaged through being travelled while the stoking element was still in the retort.

(*To be continued.*)

NOTES ON BYE-PRODUCT COKING.

[Communicated.]

THE USE OF NITRE CAKE.

THE proposed substitution of a portion of the sulphuric acid used in sulphate making by nitre cake, did not meet with much favour at the last monthly meeting of the Coke-Oven Managers' Association. The matter was thoroughly discussed from many points of view. Some of those who spoke had already given the process a good trial, and they did not speak very encouragingly of it. There is a vast difference between using nitre cake for sulphate making and for industrial purposes, as in the textile industry. In the latter case the acid is a means to an end, and does not form a part of the final product. Consequently, the purity—or otherwise—of the acid need not be considered at all, provided that it is of sufficiently good quality to accomplish the desired end. In sulphate making, however, the acid forms an integral part of the final product, and the quality of the acid is reflected in the quality of the finished product. In this way, by the use of nitre cake, an inferior sulphate of ammonia is produced, and the more inferior the nitre cake the worse will be the quality of the sulphate.

The Government circular gives what purports to be analyses of the sulphate made from nitre cake; but the general opinion of coke-oven people is that, with ordinary nitre cake under ordinary coke-oven conditions, such results as those given in the circular could not be obtained. And even if they could, the opinion as to the possibility of the sale of the inferior sulphate is decidedly unfavourable. As the Government has already restricted the export of ordinary sulphate, supplies are available considerably in excess of the home demand; so that it is not very likely that inferior sulphate could be sold in this country. During the last two or three years, a very active campaign has been carried on with the object of educating consumers, both at home and abroad, in the use of artificial manures. German competition has forced up the standard of sulphate of ammonia from 24½ per cent. to 25 per cent. of ammonia. Long articles have appeared in the Press advocating the general adoption of the latter standard, and farmers have been made to see the wisdom of it from the monetary point of view. And now we are asked to make sulphate with 18 per cent.—or less—of ammonia! No wonder it was asked, Why don't the Government sell the sulphate first? The vexed question of ignorant interference on the part of Government officials was again raised in this connection. It does seem strange that, after eighteen months of a war in which one of the most—if not the most—important industries is that of bye-products coking, there should be no official of the Ministry of Munitions who is a real practical coke-oven man. In other munitions industries the writer believes a similar state of affairs was in existence in the early days of the war, but it was gradually remedied. There has, however, apparently been no effort to alter the conditions in this particular respect. The author knows that there is a department of the Ministry of Munitions which deals with bye-product coking; but as far as he has been able to ascertain, the officials who run it are certainly not coking experts. Coke-oven engineers also complain that it is a gas engineer who is in touch with them with regard to the carbonization of pitch in coke-ovens. Here again, surely a competent coke-oven man can be found who is quite capable of dealing with the matter.

MIXING OF COALS FOR COKING.

It has frequently been stated in the past that in this country very little attention has been paid to the mixing of various classes of coal for coking purposes. In America mixing is carried out on a thoroughly scientific basis. By carefully grading individual coals, it has been found possible to produce corresponding grades of coke, while the advantage also extends to the bye-product side of the plant. In this latter connection particularly, there is much scope for investigation, and indeed at the present time such mixing could be advantageously carried out. It is known that certain classes of coal produced in this country do not yield a good quality of coke, yet they are exceedingly rich in volatile matter. By careful mixing of such coal with a first-class coking coal, the advantage of an increased yield of bye-products can be obtained. Large quantities of cannel coal are still available in this country; and it would seem to be advantageous, from the point of view of increasing the production of benzene and toluene, for a certain amount of this class of coal to be used in the manufacture of coke in bye-product ovens. Various other classes of non-coking coals, but rich in volatile matter, could be incorporated in the same way. There is at the present time, in many cases, considerable difficulty in obtaining sufficient supplies of coking slack to keep the bye-product ovens going at their full capacity. There was a little time ago some talk of the Government assuming full control of the supplies of slack for coking purposes; and if this suggestion materializes, the proposal for using non-coking coals in the above manner should certainly not be lost sight of.

DETERMINATION OF PRUSSIAN BLUE IN SPENT OXIDE.

By ERNEST L. RANDALL, Chemist, Croydon Gas Company.

TITANOUS CHLORIDE ($TiCl_3$), which was employed in the first case as a reducing agent for the estimation of ferric iron, and afterwards—thanks to the work of Knecht and Hibbert—for the determination of nitro-compounds, the azo-dyes, and dyestuffs, is the reagent which the author proposes to use for the above determination.

It was found that dilute solutions of potassium or sodium ferricyanide would, when treated with a titanous chloride solution of about 1 per cent. strength give first a light green colour, which, on further addition of the chloride, would rapidly deepen to an intense green, and then become a reddish brown. The change in colour until the reddish brown is first reached, was ascertained to be quantitative when a very liberal excess of sodium, potassium, or ammonium sulphocyanide is present. Not less than 0·1 gramme of the ferricyanide should be present. The requisite degree of dilution varies with the base of the ferricyanide; the potassium salt working well at about 0·6 gramme to the litre, and the sodium salt at about 2 grammes to the litre.

The titanous chloride was standardized by ferrous-ammonium sulphate solution, and 1 c.c. of the former was found to be equivalent to 0·00217 gm. of Fe. Calculation showed that the amount of titanous chloride solution used in the determination of potassium or sodium ferricyanide is exactly proportional to the amount of iron present. Thus, with the above strength of titanous chloride 15·7 c.c. would be required for 0·2 gramme of potassium ferricyanide. The results were within 0·3 per cent. of the theoretical. In some subsequent determinations the titanous chloride solution was standardized by a potassium ferricyanide solution of known strength. In all these titrations the titanous chloride is added a few drops at the time to the ferricyanide solution—the Ernlenmeyer flask containing the latter being well shaken after each addition. Towards the close, care is necessary, as the change proceeds somewhat slowly.

Potassium and sodium ferrocyanide solutions were also determined by oxidizing with a slight excess of permanganate, removing the slight excess by means of the liberal excess of sodium sulphocyanide necessary for titration of the ferricyanide formed, with titanous chloride. It was found that mixtures of ferricyanide and ferrocyanide could thus be determined—one portion giving the ferricyanide present, and another (after oxidation) giving the total ferricyanide, from which the ferrocyanide could easily be calculated.

In the determination of "Prussian Blue," the spent oxide is first extracted with carbon bisulphide to get rid of all free sulphur, and is then treated with caustic soda in the usual fashion, with the addition of a little ferrous sulphate to convert any cyanide into ferrocyanide. After filtering, any sulphide present is precipitated with lead carbonate, and removed. The solution is then neutralized, made up to a known volume, and an aliquot portion taken; the ferrocyanide and sulphocyanide present oxidized with a slight excess of permanganate of about N/20 strength; and the excess of permanganate removed by the addition of a large excess of sodium sulphocyanide, which alone may be used in this estimation. The titration is then carried out with the precautions previously mentioned. "Sutton's Volumetric Analysis" describes the precautions necessary in dealing with a titanous chloride solution.

Lack of time has prevented a thorough investigation of the method for determining "Prussian Blue" in spent oxide; but it is hoped these notes will induce others to make an investigation.

The last-issued volume of "Manuals of Chemical Technology" (London: Crosby Lockwood and Son) is No. VI.—"The Salt and Alkali Industry; including Potassium Salts and the Strassfürt Industry," by Messrs. Geoffrey Martin, Stanley Smith, and F. Milsom. This has just been published, price 7s. 6d. net. Vol. VII. of the series (nearly ready) will deal with "Industrial Gases; including the Liquefaction of Gases," edited by Mr. Geoffrey Martin, Ph.D.

THE ECONOMY OF FUEL.

Discussion at the Society of Chemical Industry.

At the Meeting of the London Section of the Society of Chemical Industry on Monday of last week, the subject of the economy of fuel was discussed.

Opening Remarks by Professor Bone.

Professor W. A. Bone, F.R.S., said he had not come so much with a view of giving a paper, because this subject was so large, and its ramifications so many, that it would be quite impossible to compress it into the scope of a paper. His intention was to open a discussion on the subject; and he did not propose to occupy more time than was necessary to put forward a few of the basic facts of the situation and to enlist active interest and support for the work of the Committee appointed recently by the British Association to consider this important subject from the national standpoint. He had already dealt with the matter at some length in a series of lectures recently delivered at the Royal Institution, which had been reported fully in the Technical Press[*] and would also shortly be reprinted in pamphlet form. It was much more important in regard to the task the Committee had undertaken that all interested in chemical manufacture and applications of chemistry generally should give suggestions or criticism which at this stage would be particularly helpful to the work in hand, because, unless they had behind them the driving power of an enlightened non-technical public, the labours of the Committee would be largely in vain.

National Aspect of Fuel Economy.

The national aspects of fuel economy must be considered from two standpoints: First, in view of the economic situation created by the war and the need for enforcing national economy as the best means for paying for the war, and, secondly, in view of the interests of that remoter, but nevertheless not far distant, future when our coal supply would be restricted by approaching exhaustion. It could hardly be questioned that the chief material basis for the great industrial and economic expansion of this country during the past century had been our abundant supply of easily obtainable coal, which had given us a position of great advantage over all other countries. It was also true that we could no longer claim any advantage over our two nearest competitors; and our whole economic future depended on having abundant supplies of relatively cheap coal, and also the duration of the supply of our easily workable coal seams. We had to consider how long we could continue to get coal at a cost which would not place us as a nation at a disadvantage compared with our nearest competitors. In order to appreciate the great importance of this, Professor Bone gave a number of statistics of the world's coal resources. These were given in the second Royal Institution lecture,[†] as were also the diagrams and curves reproduced on that occasion and again exhibited on Monday. It was, said Professor Bone, our duty to make these facts universally known and to insist upon the Government taking immediate action for systematic supervision of fuel consumption in all large areas, and also to undertake scientific investigations upon the better utilization of our coal supplies. Hitherto no scientific body of men had thought it worth while to take any action with regard to coal, and the time for action had now come. If chemists did not discharge this duty, they would have deservedly to forfeit all claim to leadership in public esteem. There was a large scope for effecting economies in the case of inefficient plant by an Advisory Board, because the statistics showed very much variation in the quantity of coal used by different plants of the same type.

Export Duty on Coal.

Dealing with the export of coal, this was a matter about which there was room for much difference of opinion. After repeating the facts and figures on this question given in his second lecture, he referred to Professor Armstrong's recent suggestion at Newcastle,[‡] that a small duty on all coal raised should be ear-marked for investigation into fuel economy. To this he suggested one modification—namely, a 1s. duty per ton imposed on all coal exported would bring in £5,000,000; and the Government might well impose a duty on exported coal which could be put to the purpose suggested by Professor Armstrong. He put it upon exported coal because he thought it could stand it.

Recommendation of the Royal Commission on Coal.

Strong references were made to the fact that no action had been taken to put into force the recommendations of the 1905 Royal Commission on Coal, which had estimated that savings amounting to 30 per cent. of the total fuel at present used could be made if waste could be eliminated. What public action had the Government or scientific and industrial leaders taken since 1905 to check this waste which was known through the report of the Royal Commission?

Professor Armstrong: They could not understand it.

Professor Bone (continuing) said that the answer to his question was "absolutely nothing"—the 1905 Commission might never have reported. Scientific societies should send deputations to Whitehall to insist upon something being done; scientific leaders should not allow the government to overlook such an important matter.

British Association Committees of Inquiry.

After quoting Dr. Beilby's analysis of the coal consumption of the United Kingdom, and basing a calculation upon it which agreed within close limits,[*] Professor Bone discussed the procedure which has been decided upon by the British Association Committee. He said that the scope of the inquiry was found to be so wide that the Committee had resolved itself into five Sub-Committees or groups, each under a separate Chairman. The first would deal with chemical and statistical matters, including the chemical nature of coal and the character of the principal British coal seams, under the chairmanship of Dr. Dunn, of Durham. The second Sub-Committee had under its charge questions relating to carbonization, including gas-works, coke-ovens, low-temperature distillation and the products derived therefrom. The Chairman was Mr. Greiner—a large coke-oven proprietor in the county of Durham. The third Sub-Committee would deal with power and steam raising, including the organization of public power schemes. The Chairman in this case was Mr. C. H. Merz, who organized the power scheme now supplying Durham, &c. The fourth Sub-Committee, the Chairman of which had yet to be appointed, had in charge the metallurgical and ceramic industries. The Sub-Committee included representatives of the iron and steel industry. The fifth, and final, Sub-Committee was one which had been formed to co-ordinate the work of the several local Committees, such as those in Manchester, Sheffield, Leeds, &c., constituted for the investigation of the pollution of the atmosphere and the domestic production of smoke. Of this Committee, Mr. Symon, the Chairman of the Manchester Air Pollution Committee, was in charge, and he also acted as General Secretary to the main Committee. It would be the first duty of each Sub-Committee to collect all available information and endeavour to come to some judgment upon it. For instance, the Committees on the production of power, steam raising, and metallurgy would endeavour to arrive at a judgment as to the probable average efficiencies actually realized and the best average efficiencies which might be expected by the use of the best appliances and methods, and the probable margins for economy. It had been arranged that the General Committee would sit at intervals to receive and discuss memoranda from the Sub-Committees, and such as were approved would probably be referred to a Special Sub-Committee. When the work of reviewing the present state of science and practice relative to coal in various industries was completed, the Committee would proceed to consider ways and means of effecting economies. This part of the inquiry would necessarily include a consideration of how far, and on what lines, the Government might help—either by the establishment of Fuel Advisory and Central Boards, or large-scale experiments in a central fuel experimental station, or both. To enable the Committee to achieve the best results, communications and assistance were asked for, which should be sent either to Professor Bone or Mr. Symon, of Manchester. All information so given would be treated as confidential, and due acknowledgment of the source of information used in any reports issued would be made.

Matters Requiring Special Consideration.

Professor Bone then indicated a few aspects of this question which, in his opinion, required special consideration. There was great need for very much further experimental research upon the chemical nature of coal, concerning which we were in a state of great ignorance. At present our knowledge concerning combustion and distillation of coal was entirely empirical, and must remain so until we have gained that clearer insight into the real nature of the complex compounds in coal and the methods of their decomposition by heat. Concurrently with such an inquiry there should be undertaken a systematic chemical survey of the principal coal seams in the British coalfields. Coals in different seams varied in physical texture and chemical character, and also varied over one and the same seam.

Then the problem of low-temperature distillation was of great national importance, both from the domestic fuel point of view and as a source of oil for motor spirit. The use of raw coal for domestic fires and steam raising and furnaces was a barbarous custom which could not be defended chemically; and the investigation and manufacture of "semi-coke" should not be left to private enterprise, but should be supplemented by systematic investigation on behalf of the public by disinterested experts aided by substantial Government grants.

Again, with regard to carbonization, Professor Bone referred to the unsatisfactory situation in the coking industry. It was to be deplored that out of 20 million tons of coal carbonized for hard metallurgical coke in 1913, no less than 6½ million tons were treated in bee-hive ovens, involving a loss in bye-products of £2,250,000 sterling. In face of the fact that all bee-hive ovens had long since been abolished in Germany, their continuance here was a great reflection upon our industrial economics, and the Government should be pressed to give a reasonable time limit within which every bee-hive oven installation in this country should be replaced. The present position also of bye-product coking ovens called for immediate action, and he would have thought that the Minister of Munitions would have established some sort of inspection and supervision of these ovens. He (Professor Bone) had repeatedly drawn attention to this and offered to organize control, but to no good purpose. There was great dissatisfaction at the scandalous neglect of this industry by the Government.

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[*] See "Journal" for Jan. 25, Feb. 1, and Feb. 8, pp. 206, 253, and 305.

[†] *Ibid, ante*, p. 253

[‡] *Ibid, ante*, p. 413.

[*] See "Journal," *ante*, p. 255.

Finally, with regard to the iron and steel industry, considerable progress had been made during the past few years in utilizing surplus coke-oven and blast-furnace gases; but much remained to be done to accelerate the change. If all metallurgical processes could be concentrated on one site, enormous economies could then be obtained from the rolling mills for an expenditure of no more coal than must be charged into the coking-ovens in order to provide the necessary coke for the blast-furnace gas-producer, and coal-fired boilers in rolling mills would disappear except for the manufacture of special steels. If this were done, he estimated an annual saving of 10 million tons of coal for our present output of iron and steel.

DISCUSSION.

The Chairman (Mr. A. R. Ling) mentioned that the President of the Society, Mr. Charles Carpenter, D.Sc., was present, and asked him to open the discussion.

Mr. Carpenter said he could not help feeling that they were face to face with a very grave situation, not only as it affected them at present, but as it affected the future of the country to which they were all so proud to belong. One feature of the statement made by Professor Bone must go home to everyone—namely, it was high time they realized that their birthright was not only liberty, but they should have something to do with the disposition of their coal supplies. Professor Bone had pointed out the great importance they played in the future of this country, and it was impossible not to agree with him that chemists should have something to say with regard to their disposal. The unfortunate thing was how to apply this practically. Professor Bone had described the attitude of the most up-to-date example of a Government department—namely, the Ministry of Munitions, under the very energetic supervision of the very energetic Minister who was responsible for it. They had been told how this Department was neglecting the coking industry; and yet it was to the Government that they must look if anything was to be done to put this matter on a proper basis. It was perfectly certain that individualism was entirely broken down in this matter, and that their present method of working was absolutely wrong, whether looked at from the simple point of view of the export of coal, which went on untrammelled and uncontrolled in any way (for a few pence per ton of coal, the supplier sent coal out of the country to those who were competing with England in nearly all industries), or whether it was looked at from the point of view of the utilization of the energy existing in the coal. From both points of view, the present state of affairs was equally impossible. He would like to support Professor Bone's suggestion with regard to the great importance of arriving at some information as to what was possible in the way of converting the energy of coal into fuel. Speaking for one of the industries which had been mentioned, he could not imagine that there was any industry in this country which knew so little of what was going on in carbonizing its coal, or was so absolutely ignorant as to what was being done and what it was possible to do, than the industry responsible for the carbonizing of coal for the production of illuminating gas. They were absolutely empirical. He did not know that any steps had been taken except of the crudest and most elementary nature to fix a goal in the direction of which they should work. There was no basis of information to guide them as to how coal should be carbonized, and as to the degree in which they were achieving the result it was possible to obtain. Also he did not think it was possible to rely upon those responsible for working gas undertakings. These people were not any different from any other manufacturers; and he did not think they would take upon themselves the responsibility of making the investigations which Professor Bone had suggested. A great deal could be done with the admirable suggestion made by Professor Armstrong—that a tax should be levied on all coal raised, such a tax to be applied for the specific purpose of protecting, if he might say so, the user of fuel in any form. It was very interesting to him, as a practical man, to have heard two practical suggestions such as had been made by Professor Bone that evening and by Professor Armstrong at Newcastle a short time ago. He could hardly realize, in listening to them, that he was listening to what was sometimes spoken of, perhaps unjustly, as the more scientific element. Professor Armstrong and Professor Bone had given two eminently practical papers as to how this matter should be put on a proper basis. As the Society of Chemical Industry, they were primarily interested in getting the best possible results from the most valuable raw material that they possessed; and, as had been pointed out, it was their bounden duty to take this matter very seriously and bring it home to the Government. It was very easy to say "bring it home to the Government;" and he quite realized that this was one of the most difficult problems with which the industry was faced. But, however difficult it might be, and whatever course they might take, it was the bounden duty of the Society to do all it could in the direction of bringing it home to the Government. With regard to the work Professor Bone had done upon the utilization of the energy of gas, like many other pioneers and investigators, he was not likely to reap the benefit which he (the speaker) felt was bound to accrue from this work. Professor Bone had set a great many people thinking as to how the energy of gas could be utilized; and it was a simple fact that in many cases it had been proved to be economical, and on a considerable scale, to substitute gas heating for solid fuel—*i.e.*, the burning of raw coal—simply by reason of the fact that the amount of heat to be put in for the article required to be heated was so absolutely susceptible to control. He knew not a few cases in which these principles, for which Professor Bone had been responsible, had been applied with a considerable amount of economy—not perhaps in the way that Professor Bone had first suggested, but in other ways.

Professor Armstrong said the thing that surprised him was that those present had not risen in a body and stoned Professor Bone, out of very shame. Why should Professor Bone come there and speak of a Committee of the British Association with regard to work which the Society of Chemical Industry ought to have done years and years ago? What was the Committee of the British Association? It was really a Committee of one with power to add to its number. This Committee was Professor Bone; and he had accumulated certain men around him. The British Association was a mere thing of imagination—it did not exist except for a few hours every year; and it was a pure farce that a subject of this terrific importance should be undertaken in such a way. Were the members of the Society of Chemical Industry or were they not going to take up this matter themselves? They should not for one moment allow Professor Bone to continue this so-called British Association Committee. It should be a Committee of the whole Society of Chemical Industry. He had been told in that room only that day that the Society of Chemical Industry was not fit to be a Society for industry. It was said quite seriously. This was the position they were in. What had been done all these years to justify the existence of the Society; and were they going to do anything? Were they going forward within the next week or two and say what Lord Haldane had said must be the policy of the nation, and tell the Government what to do and then follow it up? They all knew the problem was one of great importance, upon which their whole existence as a commercial nation was at stake. There was no question of thinking of Germany in this matter, because 64 per cent. of the coal of the world was in the United States. This was the fact which was going to trouble them in the future; and it would be unnecessary to bother about the Germans. Germany might affect them for a few years after the war, because they would still be organized while we should not be organized; but Germany would not affect them very long against the terrific store of raw material which the United States had. This was merely a question of coal output; but it would be necessary to look at the matter from the point of view of the use Germany was going to make of coal in comparison with our use of it here. Professor Bone had started flameless combustion some years ago; but as this had got into the hands of the company promoter, Professor Bone was now out of it, and the whole thing was asleep. Professor Bone had been talking about earmarking a duty on coal exports; but he proposed that they should earmark Professor Bone and get him away from the task of collecting information for the British Association Committee, and set him to work doing what he, more than anyone else in this country could do—namely, develop the subject of flameless combustion. The Germans were working at this as hard as they could; and the Society of Chemical Industry would lose its standing in public esteem if it did not come forward for the protection of the public against the Company promoter, who was going to start on these soft-coal schemes—there were signs of him everywhere. People were going to lose their money on enterprises of this kind; but the problems involved could not be solved by small-scale experiments. The Society must, if it were going to do anything at all, appoint a small Committee to draft a memorial to Mr. M'Kenna, Mr. Lloyd George, and the other ignoramuses with regard to matters of this kind. Unless the Society took this opportunity at once and did something, it could not last. At all events, if it could not do anything it would not be worth while lasting.

Mr. Jacques Abady said there could be no dispute as to the importance of the subject which Professor Bone had brought forward; but it seemed to him that there was the other end of the aspect of the difficulties which had been mentioned—namely, the end which did not begin with the chemist but which began with the public. It must be somebody's function to see to it that the public used coal only in a way that was economical. It might be said that this was a matter for which the chemist must take the whole responsibility. From what Professor Bone had said with reference to the Government attitude as to coke-ovens, it would appear almost as if the chemist was waiting for the Government to tell him what to do, instead of the Government waiting for the chemist to tell them what to do. With respect to the consumption of coal, it was an undisputable fact that coal must be used; and the use might be divided into industrial and domestic. There was, however, one essential fact outstanding very clearly indeed—that if for either of these purposes coal was being used in what might be termed open combustion as compared with closed distillation for the recovery of bye-products, then every ton of coal so used was so much money thrown away.

Therefore, was not the practical question to direct attention upon spreading the gospel of the use of coal by closed distillation rather than by open combustion, and, if necessary, to try to foster legislation or action on the part of the Central Government and local or municipal authorities which would encourage this object? This did not mean that he was preaching the gospel of the universal use of gas, because closed distillation gave rise to the production of gas and coke in addition to tar and other valuable bye-products. At the same time, they were hiding in the sand, it seemed to him, and deceiving themselves if, for instance, as had been hinted in reference to Mr. Merz's electric scheme in the North of England, it was suggested that, in utilizing electricity for power, they were doing away with the waste of coal. Unless electricity was produced by some method of combustion in which bye-products were recovered, and this combustion was applied to prime movers which were economical, they would be deceiving themselves if they thought they were being economical by using electricity. This was the whole point, and the only point to which every effort, from the Government down to the chemist, must be directed—viz., the one problem how to make the use of coal universal when the coal was employed as heat obtained by closed distillation as opposed to open combustion.

Mr. W. J. A. **Butterfield**, speaking with regard to the consumption of coal for power purposes, said it was all-important that the Committee should see that the machines and apparatus for the consumption of gaseous fuel should be brought to a higher state of efficiency. The central power station engineer at the present time would not look at an internal combustion engine to produce power. He was convinced that it was not reliable on a large scale to turn out power night and day. This was a matter the Committee might very well look into—namely, the reliability and efficiency of the large gas-engine. The power station engineer at present, apart from the question of reliability, might look at the matter in this way. If he proposed to gasify his fuel, he had to lose 25 per cent. of the calorific power in the carbonizers or producers. Burning this fuel in his boilers he obtained an efficiency of 80 per cent., which gave a total utilization of only 60 per cent. of the calorific power of the fuel in the boilers. With an evaporation which had been obtained in central stations of 9 lbs. of steam per pound of coal, the engineer was getting more nearly 65 per cent. of the heat of the coal consumed; and if they were to convince an up-to-date power station engineer that he would do better to go over to the gasification of his fuel, it would be necessary to improve the efficiency of the large internal combustion engine. There were other directions in which gaseous fuel machinery needed improvement. In the cement industry, about 25 years ago, the earliest rotary cement kilns were fired by producer gas. This had all gone, because it had been found that a better efficiency was obtainable with direct-firing with coal dust. He believed this was due to the improper use of gaseous fuel in the earliest rotary kilns. With regard to the solid product of low-temperature distillation, this suffered from the same disadvantage from which coke, to a less degree, had suffered—namely, that it was a very bulky product. Only half the quantity could be put into a cellar compared with coal; and this was a serious matter with small cellars in town areas. It also meant carrying two scuttles of coke to one of coal—again, a serious matter. It was on these grounds that they must look to gas as the domestic fuel almost entirely, and not to the solid product of carbonization.*

Mr. **Walter Reid** thought Professor Armstrong was right in the importance he attached to the British Association Committee. He did not think it would have much influence with the Government, as the British Association did not control enough votes. Far from the Society of Chemical Industry following the British Association, it was the fact that the British Association were following the Society. This matter was discussed very fully at the annual meeting of the Society in Manchester, when he read a paper on the subject; and he remembered the figures which Professor Bone had used that evening as to the production of coal, and, indeed, he had given other figures in the Society's "Journal" of July 31 last year. Important in this connection was the coal production of the Central Powers and the coal production of ourselves and our Allies. The former figure worked out at 366,000,000 tons per annum, while for ourselves and our Allies it was 411,000,000 tons per annum; so that the two were now getting very close together. This was very important because the production of high explosives depended upon the production of coal. With regard to power gas and electricity, he did not think that private enterprise was altogether idle, as very many people of great experience were at work upon it. There was a good deal called waste in work of this description which was not waste from the commercial point of view. Carriage was an important matter, as Mr. Butterfield had pointed out. With regard to the utilization of coal for the production of heat, the cement industry was an important one; and the production of power from pulverized coal was being experimented with at the present moment. If these difficulties could be surmounted, then the use of gas would be done away with altogether. Anything that could put a stop to the domestic consumption of coal in the open grate would undoubtedly be a great national advantage. He was glad that so much good work was being done in this direction at Manchester and elsewhere. At the same time he would like to point out that the original work of this description was started by the Coal Smoke Abatement Society, which had very largely resulted in the elimination of those dense fogs hitherto so frequent in London. He agreed with the suggestion of an export tax on coal, to be ear-marked for experimental purposes.

Dr. H. A. D. **Jowett** thought the industry must take cognizance of the fact that there was much to be done in educating not only the Government but the public generally as to the best use of coal. All those who had tried to introduce other forms of heating than open grates in their houses knew the difficulties to be contended with from the other members of the household. He was surprised that such little progress had been made in this country with steam or hot water heating, either by gas or coke furnaces, although, of course, our houses did not lend themselves to this very well, while the climate was not particularly adapted. It was now many years ago that a central station power scheme for London was talked of; but had the chemical industry done anything to make their authority felt? It was a serious matter for manufacturers around London to obtain cheap power, although recent events had rather changed their ideas, and made them feel that it would not do to rely upon one large power station for London.

Mr. R. H. **Clayton** suggested that more good would be done by a little less talking against the Government and more work on the part of the industry. The Manchester Committee on Air Pollution had shown what could be done.

Mr. C. A. **Klein** asked what the industry had done since last year to take definite steps to tackle this question? Did the Council propose to send Professor Bone's and Professor Armstrong's papers to each section for discussion, for those sections to reply to the Council stating their conclusions, and for the Council then to bring the matter before the next general meeting of the Society and state positively whether it would take any definite action or not? Professor Bone had told his story on several occasions, and Professor Armstrong had been talking in the same direction for many years; but very little had been done from the chemical point of view.

Professor **Bone**, who interposed at this stage as he had to leave the meeting, said he really did not care in the slightest as to the question of priority in bringing this matter forward, nor what label was attached to the Committee and the men who had set themselves to find out the facts of the situation. The Committee included men who were really going to take the matter in hand in a thorough manner, and they did not care by what name or title they were spoken of—they were going to do the work. Reference had been made to the electrical arrangements in London; but he regarded them as a disgrace to a civilized community. In an area comprising 7¼ million people, there were 65 separate authorities supplying electricity upon 49 different systems, from 70 generating stations, containing 585 engines, and distributing at 55 voltages to the consumer, who was charged upon one or other of 70 rates and prices. The average size of the generating stations was 5285 kilowatts, and the average size of the generating units only 632 kilowatts. These included many reciprocating engines; and some of the stations even had to cart their own coal. He did not consider this either modern or economical or showing any sign of progress whatever. Even the largest engine used to generate electricity, and the load factor of it, was uneconomical compared with the conditions in Paris, Berlin, or New York. There was nothing in London which came within ten years of what was realized elsewhere; and he could not agree that London could be held up in any shape or form as an example. The subject needed to be thoroughly discussed, not only as it had been that evening on the spur of the moment, but it was necessary for everyone to put his views, after due consideration, in writing, because this would be most valuable to the work of the Committee and the men with whom it was associated.

Mr. S. O. **Neville**, rising as a member of the brewing industry, spoke of the great field for economy in coal consumption, and mentioned that he himself, who knew nothing about the matter at all, had in one case been able to reduce the amount of coal burnt from 90 lbs. per barrel to 50 lbs.; while if the installation had been properly laid out in the first place, the amount need have been no more than 30 lbs. He was quite prepared to believe that an expert would have obtained still better results. The difficulty, however, was that smaller undertakings of this description could not afford to have an engineer on the premises; and he suggested that the Home Office factory inspectors should be reinforced by several engineers whose business it should be to give information of the character mentioned to small factory owners, and test their fuel consumption.

The **Chairman**, in proposing a hearty vote of thanks to Professor Bone, said that everyone seemed to be agreed that we were utilizing fuel in a very indifferent manner, and perhaps he might ask the President to be kind enough to carry out Professor Armstrong's suggestion and request the Council to form a small Committee of the Society to deal with the matter.

We are pleased to learn that Mr. John Holliday has been promoted from Corporal to commissioned rank, and is a Second Lieutenant in the Royal Engineers. Lieutenant Holliday, it may be remembered, after being wounded in France, spent some time in hospital in this country towards the end of last year.

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* The first portion of an article giving the further views of Mr. Butterfield on this subject appears elsewhere to-day.—Ed. J.G.L.

AN AFTERNOON AT LOWER SYDENHAM.

A Machine for Loading Coal into Trucks.

For the third time, last Saturday afternoon members of the London and Southern District Junior Gas Association were made heartily welcomed at the Lower Sydenham works of the South Suburban Gas Company. The fact that only two years had elapsed since the last visit detracted not at all from the interest of those present in all they saw; nor, it may be added, did it lessen in the smallest degree the cordiality with which they were received. At the present time, a visit to the works was particularly appropriate; for they are the property of the Company in whose service is Mr. S. B. Chandler, the President of the Association. About forty members turned up; and with so many willing guides available, it was possible to arrange parties of such dimensions that everyone was able to put such questions as arose, and hear the explanations and descriptions which were given of the different appliances about the works. Consequently, a thoroughly profitable and pleasant afternoon was spent—a fact which was made evident at the subsequent tea, when the Directors of the Company and the Chief Engineer (Mr. S. Y. Shoubridge) were heartily thanked for their kindness in throwing the works open once more, and receiving the Association so hospitably. On arrival, the different parties were taken in charge by Mr. F. G. Gorman (the Works Superintendent), Mr. A. V. Hendrickson (Chemist), Mr. W. G. Waller and Mr. G. Ross (Employee Directors), Mr. K. Gandon, and Mr. J. Dickenson.

As before, one of the many features of the works proved to be the cleanliness and orderliness observable, although, admittedly, this is, what with labour shortage and bad weather, not a time when gas-works are at their best. How well machinery can be kept was shown at the very start of the tour in the booster-house, from which gas is sent at 36 inches pressure, by means of a special high-pressure main, to Bromley, about 4½ miles away, to be distributed from there to various areas. For this purpose, there are three exhausters; and there is, in addition, a booster—a steam turbine direct coupled to the fan—for maintaining the pressure in the mains, when necessary, in the Sydenham district. The first of the three retort-houses visited was the inclined house—what is known as the "Shoubridge House," because the ten beds of seven 20-feet retorts are filled by means of the well-known Shoubridge charging machine, and emptied by the aid (when help is required) of the Shoubridge discharger, instead of resorting to the customary "tickling" process. The charger consists of a big radius shoot, which gives an impetus to the coal; while the discharger is a ram so geared as to be very easily worked by the turning of a handwheel—the operation, in fact, taking less than a minute. As to the economy of the house, it may be pointed out that one man only is needed on the charging stage; and he could look after several more settings, if it were practicable to extend the house. Twelve-hour charges of 12 cwt. are worked; the capacity of the house being 1,100,000 cubic feet per day. The other two houses are fitted with De Brouwer stoking machinery. In one case it is worked by electricity generated by gas-engines and dynamos, and in the other by compressed air. Twelve-hour charges are worked, with practically full retorts. In the electrical house, 260 22-feet horizontal retorts have an output of 4,600,000 cubic feet per 24 hours. An endless De Brouwer chain conveyor removes the coke, which is loaded direct into railway waggons or placed in the yard. The coal is brought to the house in railway trucks, emptied into an elevator, and taken into overhead hoppers. The other house contains 186 20-feet horizontal retorts, and has a capacity of some 3,000,000 cubic feet of gas a day. Here, again, the coke is removed by a De Brouwer conveyor; and there is an excellently arranged plant for delivering it direct into railway waggons.

In connection with the coal-handling, the visitors were able to see a machine which was a decided novelty for them. In fact, while largely employed in collieries in this country, it is believed to have been the first appliance of its kind to be put to work in an English gas-works, though since it was purchased a similar machine has been installed on the Tottenham Gas-Works. It is the Jeffrey waggon and truck loader—an American machine, the English agents for which are Messrs. Hugh Wood and Co., Limited, of No. 65, Fenchurch Street, E.C.—and it is designed for loading coal from stacks into trucks, waggons, or carts. It can also be employed for loading coke into waggons. The whole thing is self-contained, and self-propelled; the driving power in this case being a small petrol engine, though an electric motor can, of course, be substituted. The machine consists of a portable bucket elevator, attached to a boom, hinged in the centre, which can be lowered when moving from one place to another. It has a radius of about 20 feet from the waggon being loaded into; and the nominal handling capacity on large heaps is about 1 ton of coal per minute. The buckets, after elevating the coal, tip it into a shoot, which directs it into the waggon. The elevator is operated independently of the travel of the machine. The arrangement is found to be a very efficient one; three men by its aid doing the work roughly of nine men. The quantity of coal handled at the works is about 130 tons per day of six or seven hours; a truck being loaded in something like ten minutes. When put into the waggons, the coal is taken by the Company's locomotives to the retort-house. There is provision on the top of some of the machines of this type, when intended to deal with coke, for screening the coke, and hoppers from which it can be bagged.

Some time was spent in the brick-making department, in which the Company make the whole of the fire-bricks they require; the method being to utilize, in about equal proportions, old material, ground and sifted, and new clay. Bricks and blocks of all shapes and sizes are made here; and even retorts have been quite successfully turned out. The facilities afforded by the large moulding-shop, of course, enable the staff to secure promptly any experimental shapes of brick; and, in addition to this, the department has much to recommend it from an economical point of view. One man, and sometimes two, can make all the bricks, &c., that are needed. Near by the visitors saw again how small things as well as big receive the most careful consideration in these works; for they were able to inspect a sample of the first-rate non-conducting composition for steam-pipes, and similar uses, which it has for some time past been the custom here to make out of waste paper, suitably treated, and mixed with some horse hair, and a little clay.

Reaching the stove shops, the members were taken in hand by Mr. Rix, the foreman, who showed them the Bower-Barffing retorts, and the chamber in which the grease is burned off the cookers. In this oven, the cookers, with the enamel linings, are subjected for three hours to a temperature of from 900° to 1000° Fahr.; and this removes the stains from the enamel, and reduces the grease to a dust, which can be easily removed by a wire brush. The brass fittings, having first been taken off the cookers, are subjected to boiling, and then polished. Each stove afterwards receives two coats of paint, and is tested before it goes out again on to the district. As on the last occasion when they were at the works, the visitors were warm in their praise of the renovated fittings, in all styles of finish, which were inspected in the lacquering shop. A point which attracted attention while passing through the commodious cooker and fire stores was the substantial amount of space which it is found necessary to set aside for the reception of the numerous shapes, sorts, and sizes of fuel designed for the different makes of fires.

Passing from one building to another, a number of boxes filled with clay were noticed distributed about; and it was explained by Mr. Gorman that this provision had been made in view of the possibility of a bomb being dropped by air-craft on one of the mains. Tar dehydration is carried out by means of a Hird-Chambers plant; and while referring to this matter, it may be remarked that on the Cutler water-gas plant sight-seals in the seal-boxes enable one to see the quality of the tar being continually emitted from the plant. By the way, some of the carburetted water-gas plant has been put in since the last visit. At that time, there were two units of 1 million cubic feet capacity per day each, on the Economical Gas Apparatus Construction Company's system; and to these were added last year two Cutler sets of like capacity, provided with every modern improvement.

The water supply for the works is derived from an artesian well; and in this connection, again, the visitors were able to see something new, a water softening plant having been put up, of a kind that is in use by the Commercial Gas Company. Waste water from different parts of the plant is led into a boiler, into which all the exhaust steam from the various engines is admitted. The water is boiled up, bringing down the temporary hardness; and a solution of washing soda is added to reduce permanent hardness. The treated water flows into three settling tanks where the mud settles out, and leaves the treated water free, to be pumped into the boilers at a comparatively high temperature.

In the meter-shops, the parties were met by Mr. Green, the foreman, who had some interesting points to put before them. They saw in successful use a tinmen's stove moulded on the works, at a very trifling cost, in one piece of fire-brick; and there were a number of the stoves on the ground waiting to be connected-up. This does not complete the tale of articles at the South Suburban Gas-Works to which the description of "home-made" can be applied. Within the last few weeks, the work has been undertaken of turning out meter diaphragms of all sizes. The arrangements for testing meters are of a complete character; and it is the aim that each meter shall be tested about once every five years. In this department, and for soldering and general overhauling, female labour has been requisitioned to take the place of the absent men. The women are found to be quite efficient, and to master the work very quickly.

Bearing on the parts of the works that have been specifically referred to here, it may be mentioned that the Company have, roughly speaking, 68,000 meters in use, over 49,000 cookers, and nearly 19,000 fires. The quantity of coal carbonized last year was 142,900 tons, and of oil used 1,089,000 gallons; the production of gas being 2,309,649,000 cubic feet. Of the 1230 employees, 260 are now serving with the Colours. The total manufacturing capacity of the works is 12 million cubic feet per day, of which 8 million cubic feet is coal gas; and the land occupied by the works is 45 acres in extent. By the purchase a few years ago of the undertakings of the Bromley and Crays and the West Kent Companies, the area of the district of supply was extended to 98 square miles.

The inspection concluded, tea was served—Mr. Shoubridge occupying the chair—in the well-appointed Livesey Memorial Hall; many of the visitors afterwards remaining for a friendly game in the large billiard-room.

Mr. SHOUBRIDGE said it was a great pleasure to him, on behalf of the Board of Directors, to offer the Association a very hearty welcome. The Directors were very glad indeed to know that the members intended to visit the works; and both he and his staff were exceedingly pleased to see them. He could hardly hope that in going round the works the members had seen anything particularly novel to them; but they had, he trusted, come across some things of sufficient interest to make them feel that their time had not been wasted. It seemed to him that a visit to a manufactory where working operations were going on was very interesting and very profitable. One could learn something from every place visited, even if it was only what to avoid. They did not claim to have novelties on the works; but in some respects they did things differently from other works. Members could compare what they had seen there and elsewhere, and in this way no doubt learn a good deal. Of course, at this time of stress and strain owing to the war, when men were very hard to get, and much harder to keep, and there were great difficulties in getting hold of raw materials, gas-works did not look at their best; but if they had gained any knowledge by their visit, all those connected with the Company would feel well repaid for any assistance they had given.

The PRESIDENT said the remarks of Mr. Shoubridge had served to emphasize the interest taken by the Company in the welfare of the Association. Mr. Charles Hunt, the Chairman, and Mr. Shoubridge were patrons of the Association; and Mr. Wilfrid Wastell, the Secretary, was one of the honorary members.

The SENIOR VICE-PRESIDENT (Mr. F. Pearce) proposed a very hearty vote of thanks to the Directors of the Company, Mr. Shoubridge, and his staff, for the enjoyable afternoon they had spent, and the hospitality shown them. Mr. Shoubridge had remarked that the present was not the best time at which to see a gas-works; but by what they had seen in the works very great credit indeed was reflected on the whole of the staff and the employees generally. The excellent condition in which they were kept spoke well for everybody concerned.

Mr. J. HEWETT (who seconded) said Mr. Shoubridge had told them he did not claim that there was anything particularly novel to be seen on the works. There was at any rate one thing in the inclined retort-house to which he would apply this term, and that was the arrangement for bringing about the result usually attained by "tickling" the charge. This appliance was the very thing for the purpose. It was not clumsy; and it did just what was required. He had not seen anything like it in other works. Another novelty was in connection with the waste-gas flue. He did not think there were many gas-works which could claim to show an effluent gas flue from the retort-house which had the modest colouring that they had seen there. It was very difficult indeed to detect anything in the way of redness. Having taken part in previous visits as well as that one, he had arrived at the conclusion that it would be impossible to go to the South Suburban Gas-Works at any time and find anything out of order.

Mr. WALLER, after the vote had been enthusiastically carried, suitably acknowledged it on behalf of the Company. The Directors, he said again, were very pleased that the members should be there; and he hoped, among the various appliances and processes, they had seen something which would be of use to them in the future. A very great deal of what they had inspected had been made and erected by the Company's own men, under the supervision of Mr. Shoubridge. He conveyed to Mr. Chandler the hearty congratulations of the Directors on his election as President of the Association for this year.

INVESTIGATION ON COMBUSTION IN THE MÉKER AND TECLU BURNERS.

By MARION LOWE, of Sheffield.

We recently received a communication dealing with the composition of gases in the flames given by the Méker and Teclu burners. Pending the time when we are able to publish the contribution in full, it may be of interest to give a brief summary of the writer's conclusions.

Gases from various parts of the flame of each type of burner were withdrawn by means of a fine-bore silica tube and analyzed. It was found that, as soon as combustion commenced, the unsaturated hydrocarbons disappeared and a large quantity of CO was found. The combustion in the upper portion of the flame was almost entirely due to CO. In the Méker burner a very great drop in the oxygen occurred in the first half centimetre above the top of the burner; and this was accompanied, of course, by a corresponding increase in CO and CO_2.

The oxidizing gases present in the flame are CO_2, H_2O, and O; the reducing gases consist essentially of CO and small quantities of H_2 due to the reversible reaction:

$$2H_2O \rightleftharpoons 2H_2 + O_2.$$

An attempt was made to determine the actual point in the flame at which the atmosphere ceased to become reducing, and began to become oxidizing; but, although unsuccessful, it was apparent that this point is reached within a very short space after combustion has started. It was also noted that the point of most intense combustion found in these experiments exactly corresponded with the point of highest temperature as found by other experimenters.

According to a "Morning Post" telegram, a Stavanger evening paper states that a Norwegian Company has been formed for the purpose of exploiting the extensive coalfields of Beeren Island, near Spitzbergen. Geologists and engineers who have investigated the deposits report that the quantity of coal obtainable is practically inexhaustible; while it is of very good quality—its heating power being, it is said, greater than that of ordinary British coal. Beeren Island is always accessible, so that it will be possible to export during the whole of the year. It is expected that there will be no difficulty in finding good harbours.

THORIUM AND ITS USE FOR INCANDESCENT MANTLES.

An article by Mr. Thurston Owens, of New York, in the "Chemical Engineer," Vol. XXII., No. 6, gives an interesting review of this subject. He remarks that at the present time 300 million gas mantles are consumed annually throughout the world—all dependent upon the supply of thorium. Some 80 millions are used yearly in the United States—double the quantity consumed ten years ago. These and other valuable facts are brought out in a recent publication of the Bureau of Mines, prepared by Mr. Karl L. Kithil ["Monazite, Thorium, and Mesothorium," Technical Paper No. 110, Bureau of Mines, Department of the Interior, Washington].

It was not until 1891, he continues, that Dr. Auer perfected his formula of 99 per cent. of thorium and 1 per cent. of cerium, which produced the highest light efficiency, and also the nearest approach to white light in colour. For 25 years the mantles used by the gas industry have been produced with this formula as a base—another of the many features of continuity and stability which characterizes the industry.

Thorium is one of the constituents of monazite sand; the others having great chemical interest but little commercial value [Whitaker]. There are numerous occurrences of monazite sand throughout the world; but it has only been mined successfully in North and South America [Kithil]. This last statement is open to question, as the deposits at Travancore, in India, have been the subject of considerable British wrath during the last few months.

"Germany, by underhand as well as straightforward methods, was steadily proceeding towards the fulfilment of her ambition to control the thorium supply of the world when war broke out." The article from which this is quoted goes on to explain how the Auer Company obtained a controlling interest in the leases at Travancore, which was nullified by an edict of the Secretary of State for India reducing the voting power of the "enemy shares," and instructing the Company to sell to all purchasers upon an equal basis. The British India sand which has reached this country [America] is reported to be far superior to the Brazilian product. The mining of monazite sand in America has been practically abandoned since 1906; and none of the large users see any commercial possibilities in this field.

In order to obtain thorium, two definite steps are necessary. The first consists of separating monazite from the other materials mined, which is done in the neighbourhood of the mine. The monazite sand is then shipped to the laboratories of mantle manufacturers, where the thorium is extracted.

"The manufacture of nitrate of thorium from monazite sand is a very difficult and complicated chemical process. It requires from four to six months to recover the small percentage of thorium and render it sufficiently pure to be used in the manufacture of lighting fluid." [Whitaker].

The treatment of monazite for the extraction of thorium described by Soddy ["Chemistry of the Radio-Elements"] is next quoted by Mr. Thurston Owens; and then he continues: In the manufacture of thorium nitrate from monazite a large amount of residues of the cerium group of rare earths is obtained. Monazite contains 60 to 70 per cent. of the cerium group or other rare earths besides thorium, and 3000 tons, which is the annual consumption of monazite, gives about 1000 tons of cerium and about 1200 tons of a mixture of the rare earths lanthanum, neodymium, and praseodymium oxides. Considerable research work has been done in order to utilize these waste materials; and experiments have been made with almost every one of them. In order to obtain and separate the rare-earth elements thousands of crystallizations and fractionations are necessary, although cerium itself is separated with comparative ease. The untiring work carried on in the research laboratories of the industries as well as by the scientists in both America and in Europe will no doubt in time be crowned with successful technical applications of the bye-products.

The monazite resources are given by Kithil as follows: It is difficult to form even a rough estimate of the quantities of monazite obtainable in the various countries. From close calculations, however, it is estimated that the lands in the marinhas along the seacoast of Brazil may yield from 15,000 to 20,000 tons of pure monazite. This does not include coast lands, where the deposits have been formed in comparatively short time. In the interior of Brazil the writer knows of 18,000,000 acres of monazite-bearing gravel deposits, which should yield monazite containing 4½ per cent. of thorium oxide; and it can be estimated that these gravels contain 45,000 to 60,000 tons of monazite. No doubt there will be found many other deposits of greater or less extent in the interior of Brazil; but no single deposit in the interior, so far as known, would warrant the erection of large plant. In sections where several large deposits are found together or near each other, a washing and concentrating plant might be profitably established, provided the price for the monazite obtained were higher than at present, and especially if transportation facilities from the interior to the coast become better.

The amount of purified monazite available in the Carolinas may be conservatively estimated at about 15,000 to 20,000 tons (4½ per cent. ThO_2). With better methods of mining and refining perhaps these deposits could be profitably exploited at the present prices for monazite and thorium nitrate—especially if the mining of monazite were carried on in connection with the manufacture of thorium nitrate and mesothorium.

It is known that attempts have been made to extract the monazite from the native rock, but this operation with even the richest rock known—0·1 to 0·2 per cent. of monazite—has proved too expensive.

In view of the increased price of thorium, the "American Gaslight Journal" has obtained expressions from several of the large users of thorium regarding changes in the tariff that would forestall any increase in the retail price of the gas mantles. The opinion seems to be general that as long as the American mantle-makers can obtain monazite sand from abroad, the prospects of using American deposits are doubtful. On the other hand, a reduction in the tariff on sand, and an increased duty on the finished mantle, would do much to stabilize the industry. As an incentive to American manufacturers the duty is hardly scientific, as it calls for 25 per cent. *ad valorem* on sand, thorium, and on mantles.

CURIOUS CASE OF A GAS-MAIN STOPPAGE.

A peculiar instance of a stoppage in a gas-main at Ysselsteyn, a small town in Holland, was recorded recently by "Het Gas."

One evening in November, urgent need arose to open the retort-lids, as the pressure on the retorts and the works mains had increased to such an extent that the water in the pressure-gauges had been blown out, and the water-seals in a number of syphons on the works had been broken. As the delivery of gas from the works remained normal, nothing but a blocked gasholder inlet could be the cause. On opening the holder bye-pass, the water from the meter connected to the gasholder outlet flowed to the governor. Everything pointed to a leakage in the holder inlet; and that this supposition was a right one, was demonstrated by a jet of water many feet high from the syphon when the plug was taken away. By opening the manhole in the holder outlet, it was possible to remove the greater part of the water, and the gas-way through the bye-pass became free again; the work having been performed in so short a time that the public lighting in the town had not suffered. Careful inspection revealed the cause of the occurrence. The holder is constructed on a concrete bed-plate; and this foundation had given way unequally, with the result that the holder had shifted, and the crown had then thrust aside the gas-inlet pipe, and broken it. As the same fate might overtake the outlet pipe, the urgency of repairing was obvious; but, before everything, it was important to have all the pipes and fittings at hand—there being but one holder on the works.

The retort-house having three semi-producer ovens, one with eight and two with five retorts, was adequate for a daily output of 86,400 cubic feet. The consumption varied between 50,400 and 57,600 cubic feet; the maximum hourly consumption being about 5760 feet. For charging, there is a stoking-machine. The question was how to ensure an even pressure on the governor-inlet; and for this purpose, the following apparatus was constructed. When the gasholder is bye-passed, the outlet of the station-meter corresponds with the governor-inlet as regards pressure. Therefore on the meter-outlet there was erected a 3-inch pipe with cock; the pipe rising about 3 feet above the roof. On the head of this pipe a sort of small gasholder, made of sheet iron, was placed; the dimensions being 40 inches wide and 30 inches high. At half the height of the tank, there was a small pipe for the regulation of the water-level. The bell, running on small wheels against the sides of the tank, was on the underside cut out in the form of large saw-teeth. Loaded with a sufficient quantity of iron bars, the bell could outbalance a pressure of 56-10ths. As soon as the pressure rose above this figure, the bell was raised, and gas passed along the saw-teeth till the pressure of 56-10ths was restored. This auxiliary governor being ready, a start was made on a Saturday night with the emptying of the tank of the defective holder. This was finished on Sunday morning; but in view of the gas remaining in it, further operations were suspended until Monday morning. That evening the new steel inlet and outlet pipes were ready on their places for the refilling of the tanks to begin.

During the whole of this time, the auxiliary governor remained under even control; and the task of the man in charge was to give instant notice to the retort-house when the pressure was falling, so that fresh charging of a retort was obviously necessary. In the hours of peak-load, after 4.30 p.m., this matter required great care, which is easily understood when it is mentioned that in one-and-a-half hours there had to be charged seventeen retorts, with only one stoking-machine, so that for each charge only some 4½ minutes were available. Nevertheless, the recording-gauges indicated normal lines.

The death is announced as having taken place at Richmond, Virginia, of Mr. Francis Thomas Glasgow, the father of Mr. A. G. Glasgow (Humphreys and Glasgow), of London and New York. Mr. Glasgow, sen., who was 87 years old, retired a few years ago from the position of Managing-Director of the Tredegar Iron-Works, with which he had been associated for sixty years. For several years he was on the Board of Aldermen of the city, and served on the directorate of the State Penitentiary.

FUEL OILS FROM COAL.

A paper was lately read before the Manchester Association of Engineers, by Mr. Harold Moore, M.Sc.Tech., F.C.S., on the subject of "Fuel Oils from Coal," in which the author examined the methods at present available for the carbonization of coal, and gave a brief description of the nature of the liquid fuels obtainable, and the quantity of those which might reasonably be expected to find their way on to the fuel-oil market for such internal combustion engines as are at present being run on crude petroleum, depetrolized petroleum, and petroleum residuum.

He said that, in addition to the tars produced by gas-works, coke-ovens, and low-temperature plants, tar in comparatively small quantities is a bye-product of gas-producers, oil-gas plants, and some blast-furnaces. The tar from gas-producers is too irregular in composition to become of much value as fuel in the immediate future. The tar from oil-gas plants is not a coal derivative, and is not yielded in sufficient quantity to become an important source of power. Blast-furnace tars are not available in quantity, and generally contain far too high a percentage of ash to be of use for internal combustion. There is little opportunity for coal-tar oils to become used in quantity for the production of power, unless the output be considerably increased. Previous to the outbreak of war, there was little difference in price between tar oils and petroleum products; and even at times when prices were most favourable to the use of tar oil, there was little advantage to be gained by employing it when the lower calorific value of this product was taken into consideration.

The oils derived from low-temperature carbonization processes have not yet made their appearance on the fuel market; but though higher in calorific value than the normal tar oils, there is no reason to anticipate any reduction in price in the tar-oil prices at present quoted. The cost of such oils is, to a large extent, due to the expense of carriage of the tar to some central distillery, and of the oil from distillery to buyer. It becomes evident that, if we wish to find a cheap fuel derived from coal, we must use the tar before the operation of distilling has increased its price.

Raw tars are at present obtainable at prices between 25s. and 30s. per ton—about half the price of the distilled product. The heavy tars yield on distillation only some 25 per cent. of their weight in the form of tar oil, from which figure we can deduce that there will be about four times the quantity of fuel available if the raw product be employed. The tars are produced in all parts of the country, thus reducing the cost of the transport—a point of great importance. Tars possess calorific powers about 16 per cent. lower than average petroleum oils, which is little lower than the corresponding values of their distillates.

From these facts it will be seen that, in point of economy, tars afford ideal fuels in a country possessing no petroleum resources, and a copious supply of coal. There are, however, difficulties met with in the burning of tars over and above those encountered in the burning of tar oils. It would be advisable, before going further with this question, to note the development that has taken place on the Continent, where the finding of substitute fuel oils has been the subject of much patient research, on account of the import taxes on petroleum having now brought the problem to a crisis at a very much earlier date than in this country. When the shortage became acute, manufacturers of the Continental Diesel engine turned their attention to tar oils as likely substitutes. Research in this line resulted in the invention of an ignition oil-pump, and the drawing-up of a specification in order to ensure the satisfactory quality of tar oils for use in Diesel engines. The successful running of tar oils led to experiments with raw tars; the result being that Diesel engines were found to give quite satisfactory running on vertical-retort tar. Attempts were then made to run engines of the constant-pressure type on inclined-retort, horizontal-retort, and coke-oven tars; and in May, 1913, Constam and Schlapfer, at the conclusion of their work on this subject, classed vertical-retort tars, chamber-oven tars, water-gas tars, oil-gas tars, and certain coke-oven tars as suitable for use in Diesel engines, providing special adaptations were used. The tars obtained from horizontal retorts and inclined retorts they considered unsuitable. Lignite tar products were classed as suitable for use without any adaptation of the engine. The author's experience has been in entire agreement with these conclusions.

A careful examination of the literature which has been published on this subject in Germany and Switzerland, together with a large amount of experimental work both in the chemical laboratory and on the engines of the Experimental Department of Messrs. Mirrlees, Bickerton, and Day, Limited, led Mr. Moore to come to the following conclusions regarding the properties required in tars to allow their use in Diesel engines:

1.—A high hydrogen content is desirable; it indicates the presence of aliphatic hydrocarbons, facilitates ignition, and minimizes carbonization inside the engine. Increase of carbon deposit would be expected with decrease of hydrogen content. If we consider the nature of flame yielded by the combustion of a low hydrogen hydrocarbon—for example, acetylene or benzene (both of which contain 92 per cent. of carbon and 8 per cent. of hydrogen)—both give very sooty flames.

2.—A low "free carbon" content is essential, as the greatest difficulty is experienced in obtaining complete combustion

Analyses of Fuel Oils.

Description.	Sp. Gr. at 15° C.	Water.	Ultimate Composition.				Ash.	Coke.	Net Calorific Value		Free Carbon.*
			C.	H.	O. and N.	S.			Calories.	B.Th.U.	
Horizontal-retort tar	1·180	1·75	91·5	5·2	2·6	0·5	0·20	24·0	8,645	15,561	18·2
Inclined-retort tar	1·157	1·11	89·9	6·0	3·6	0·5	0·02	18·5	8,671	15,626	14·0
Vertical-retort tar	1·089	2·25	88·0	6·8	3·8	0·6	0·03	6·1	8,664	15,613	1·7
Otto Hilgenstock coke-oven tar	1·208	6·00	90·0	5·4	3·8	0·8	0·02	26·8	8,624	15,523	23·9
Simon-Carvés coke-oven tar	1·090	0·50	88 1	5·6	6·1	0·2	0·07	6·0	9,261	16,670	traces
Chamber-oven tar	1·082	1·29	88·2	6·9	4·6	0·3	traces	7·3	8,737	15,727	3·0
Low temp. carbonization tar	1·058	3·00	85·8	8·1	5 49	0·09	0·11	8·2	8,776	15,797	2·2
Water-gas tar	1·054	0·59	92·2	6·8	0·4	0·6	traces	18·7	8,647	15,563	6·8
Blast-furnace tar	1·172	3·0	89·5	5·75	0·55	0·84	0·36	23·4	8,288	14,918	9·5
Blast-furnace tar oil	0·974	none	87·25	9·8	2·59	0·36	none	1·05	9,243	16,637	none
Oil distilled from low temp. tar.	0·884	none	85·6	11·4	2·48	0·4	none	0·84	9,558	17,204	none
Horizontal-retort tar oil	1·065	1·00	90·1	6·8	2·4	0·50	0·2	3·0	9,243	16,637	none
Pennsylvanian petroleum fuel oil	0·889	none	86·7	12·55	0·11	0·64	traces	0·60	10,108	18,194	none

and a clear exhaust when fuels rich in this substance are in use. The free carbon is a precipitate of fine amorphous carbon containing also nitrogen and oxygen, and may be considered as coke dust in an exceedingly fine state of division. It has been attempted to separate this body from the oil by numerous methods, the most successful of which was by treatment in a centrifugal machine, and found that only one-third of the free carbon present could be removed by this means. As the method is expensive and tedious, besides being ineffectual, it has never been used on a large scale. The effect of free carbon on the engine is to cause wear on the piston rings, valves, and cylinders.

3.—A high calorific power is preferable, as upon this value is dependent the work obtainable from unit weight of coal.

4.—A moderately low viscosity is preferable, as the oil must be sufficiently thin to flow through the engine service-pipes in cold weather. Low viscosity also enables a more effective pulverization—thus increasing the thermal efficiency.

5.—The fuel must contain very little water (less than 2 per cent.), as when present in larger quantities, the drops of water cause irregular running and misfiring.

6.—The coking value should be as low as possible (never over 15 per cent.), as this value is a direct measure of the liability to form deposits in the engine.

7.—The ash content must be low (not exceeding 0·15 per cent.).

From the accompanying table of properties of tars, it will be plainly seen that the tars which most closely approach the desirable qualities above set forth are those produced by low-temperature processes. The cost of such tars is difficult to prophesy, as no such product has, to the author's knowledge, been marketed on a large scale as fuel. One can, however, safely predict that such tars would be able to command a higher price than ordinary coal tars, on account of their use as liquid fuel; and in these circumstances it would not be profitable to work them for the more refined products. They would never be able to attain the price of the petroleum fuel oil. One advantage to fuel users would lie in the tendency of this competition to lower the cost of the imported oil.

The supporters of low-temperature carbonization are unanimous in calling attention to the possible yield of motor spirit; and it appears quite possible that it may be more profitable to extract this product by "topping" (as is customary with petroleum) before selling for fuel oil. It is improbable that the gas companies will adopt the low-temperature type of plant, on account of the low yield of gas; but they might be run on a small scale to enrich gas of low luminosity, as the gaseous products of the low-temperature plant are of very high candle power, if not stripped of any of their condensable contents. Professor Gray has pointed out that these processes might be used for generating electricity by employing the coke in producers, and mixing the gas from the retort with the producer gas, then burning the result in gas-engines, in which case tar and ammonia would be bye-products. The coke obtained by the low-temperature processes has been claimed to be suitable for metallurgical purposes; but there appears little likelihood of finding a successful field for its use in this direction. As no process of carbonization of coal can be successful without obtaining a suitable market for all the products, it is necessary to find some use for the coke and gas. The ammonia will, of course, find its way to the usual fields.

The yield of gas being small, it will probably be washed for motor spirit, and then burnt under the retort. The satisfactory disposal of the coke is a much more difficult problem. The yield of liquid products from the low-temperature carbonization of coal varies very much with the type of coal in use. But the processes when employing coal containing a large percentage of volatile yields large quantities of tar; and it is only upon this type of coal that any great advantage in the employment of this method of carbonization appears possible. The Premier Tarless Fuel Company, working a plant at 900° to 1000° Fahr. under a vacuum of 25 inches of mercury, obtained the following average yields of tar:

Coal Used.	Tar Yield.
Cannel (poor)	52 to 60 gallons per ton
Cannel (good)	60 to 80 ,, ,,
Slack	20 to 25 ,, ,,

Specific gravity of tar, 1·060.

This product, if carefully dehydrated, would make an excellent fuel for Diesel engines.

There is another possible solution to the fuel-oil question which has not yet been approached, and which is applicable to all types of carbonizing plants—viz., the fractional condensation of tars. This appears a cheap and economical way of obtaining ideal fuel oils. If the products were condensed in three stages—the first to contain pitch and free carbon, and the third to contain the volatile naphtha (benzene, toluene, and some xylene), the second or middle fraction would contain the products at present known to tar distillers as carbolic oil, creosote oil, and anthracene oil, together with the heavier portion of light oil. This second condensate, though probably not so well fractionated as is the case with distilled products, would nevertheless be an ideal tar oil for use in Diesel engines. Any richness in naphthalene would cause no trouble, provided the fuel service tanks were heated. The possibilities of this method of working are worthy of the consideration of gas engineers. The analysis of such a product of fractional condensation is not available; but the composition and properties would not vary much from the creosote yielded by tars obtained from similar carbonization plants.

Ignition of Gases by Electrical Discharge.

This was the title of a paper communicated recently by Mr. William Horton to the Royal Society. He considered the ignition of gases by impulsive discharge first as a function of sparking distance. It was shown that the shorter the distance the greater the spark; so that the volumes of the least igniting sparks are, in a typical case, the same for all spark lengths. Ignition may occur with intense momentary brush discharge—generally with the true disruptive spark. The products of combustion were found to be ionized and to carry a positive charge. The gases examined were mixtures in air of hydrogen, methane, propane, and pentane; of ethylene and acetylene; carbon monoxide and cyanogen; and coal gas and a mixture of equal volumes of hydrogen and methane. Hydrogen, propane, pentane, and carbon monoxide rise gradually in difficulty as the percentage of oxygen is reduced; methane is ignited by the same spark whatever the percentage of gas may be; acetylene and cyanogen have the stepped atomic type of ignition; ethylene is more inflammable in rich mixture; hydrogen and methane in equal volumes are ignited as methane in type, but hydrogen in magnitude. The limits of inflammability of the paraffins were shown to be reached—the upper limit when there is twice the volume of combustible gas to that in the mixture for perfect combustion; the lower limit when the volume of oxygen is twice that for perfect combustion less one atom to the molecule. The ignition of coal gas is through methane. Four types of electrical ignition were given, covering all from the most rapid to the slowest rate of discharge from the poles.

The "Monometer" Tinning Furnace.

With the object of decreasing the cost and increasing the efficiency of the process of coating wire with molten metal, the Monometer Manufacturing Company, Limited, of Whitehouse Street, Aston, Birmingham, have introduced a system to supersede the hitherto practised method of drawing the wire through an open pot containing the metal. Under the old plan, considerable loss through surface oxidation was regarded as inevitable; while the outstanding feature of the new system is said to be an enormous saving in residue. The melting-pot is covered by a dome-shaped casting, forming virtually a sealed chamber for the melting operation; and this chamber is supplied with inert gases from the bunsen burners under the melting-pot, so as to produce an oxygen-free atmosphere. The experience of users, it is said, is that the resultant saving in residue amounts in many instances to not less than 4s. per ton of metal melted. By means of thermostatic regulation of the burners, the temperature of the molten metal is kept constant—a very important consideration in connection with wire coating. For the supply of gas, no auxiliary mechanism is required; ordinary main pressure being utilized for the patent burner system, which comprises any desired number of bunsen burners attached to an equalizing chamber, which distributes uniformly the supply of gas to the individual burners. These latter are constructed in such a manner as, it is claimed, to produce intense heat with a remarkably low consumption of gas. There are special and ingenious arrangements for handling the wire; and any required number of wires may be coated simultaneously. Finally, the furnace is well and strongly made.

USE OF SILICA BRICKS FOR BYE-PRODUCT COKE-OVENS.

In a paper which he read at the San Francisco meeting of the American Institute of Mining Engineers, Mr. KENNETH SEAVER said it is gratifying that, though in the manufacture of refractories as a whole, foreign practice has surpassed them, the United States stands pre-eminent in the making of silica brick. In some instances, European manufacturers refused to credit the possibility of making to such specifications as are common with us, until the completed shapes were shipped for inspection. But both the manufacturers and consumers in foreign lands are now benefiting by American advanced practice in this field, as is evidenced by the orders placed there, and the efforts abroad to come up to the standard of American-made material.

In no operation has the employment of silica brick spread with such leaps and bounds as in the carbonization of coal, particularly in the bye-product coke-oven. To-day, in practically all types of oven, the structure above the floor level (except the facings) is of silica; while in the recuperative and in some regenerative types its use is extended below the oven floor as well. Because there are a number of refractories of higher silica content than the usual so-called fire-clay brick, there is sometimes a confusion as to what is meant by "silica" brick. The author refers only to a brick having a silica content of 94 per cent. or more, made usually from quartzite rock with a small percentage of lime as a binder. The term "silica" brick is sometimes rather loosely applied to brick made from highly siliceous clays, or to a quartzite refractory of mingled fire-clay and quartz rock. But such products are not considered in the paper.

MATERIALS.

The rock from which practically all high-grade silica bricks are made is a true quartzite or metamorphosed sandstone, variously known as ganister, quartz, quartzite, silica rock, &c.; the largest fields, in the order of their relative importance, being those of Pennsylvania, Wisconsin, Alabama, and Colorado. Pennsylvania manufactures from 75 to 85 per cent. of the silica brick made in the United States—nearly all from the quartzite found in the Medina and Oneida formation, quarried in Huntingdon and Blair counties. In this restricted area the quartzite is at its best; towards the north and south it becomes softer, is no longer a true quartzite, or is too much impregnated with iron. The rock is easily accessible in the counties mentioned; enormous quantities lying loose on the surface along the Juniata River and its tributaries. In the course of time it has been weathered and broken up into loose rock or "floes," as they are called, which may cover an area of 1000 acres or more. The depth usually varies from 3 or 4 feet to as much as 20 feet. Smaller floes formed in the same way are found along the flanks of the mountains; but they nowhere compare in size with those formed where the measures have been cut transversely.

This rock is sometimes quarried out of the solid measures; but by far the largest quantity used is that taken from the bodies of loose rock, as the latter is not only cheaper to work but is of more uniform quality. The white Medina formation is not composed entirely of quartzite, but is made up principally of sandstone with intermingled strata of quartzite. Thus, where the formation has been broken up, the softer sandstones unsuitable for the manufacture of silica brick have weathered away and disintegrated, leaving the larger part of the floes consisting of quartzite. When sandstone is mixed with the quartzite in the floes it is readily detected by its appearance, as it becomes much more rounded and worn in weathering than the quartzite, which retains its sharp angular edges. The individual pieces in these floes range from fist-size to boulders weighing many tons. Probably 50 per cent. of the rock occurs in pieces weighing more than 500 lbs. The largest floes are found at the gorges of the Juniata River near the towns of Mount Union, Mapleton, Point View, Lewistown, &c.

It is interesting to note that the Oriskany sandstone, extensively used as glass sand, is found in close proximity to the Medina, and that, although exceedingly pure in its composition, its softness renders it unsuitable for high-grade silica brick. It consists of a mass of minute quartz grains, loosely held together, and often so friable that it can easily be worn away by the hands. On the other hand, the Medina quartzite consists of quartz crystals cemented in a mixture of the same composition. The difference in the two types of rock, when ground for the manufacture of brick, is obvious. The harder stone gives splintery, angular fragments; the other, rounded grains. Experience shows that a hard rock like the Medina is required for physically strong silica brick.

An analysis of the Pennsylvania quartzite is as follows:

	Per Cent.
Silica (SiO_2)	97·80
Alumina (Al_2O_3)	0·90
Ferric oxide (Fe_2O_3)	0·85
Lime (CaO)	0·10
Magnesia (MgO)	0·15
Alkalies	0·20

METHOD OF MANUFACTURE.

Grinding.—After the rock, broken to one man size, is received at the brick plant, it is put through a crusher, which reduces it to practically the size of a 1-inch to 2-inch ring. It is then elevated to storage bins, from which it may be fed in weighed quantities to the wet pans for grinding. Into the wet pans, as the grinding proceeds, 2 per cent. of lime, by weight, is introduced as milk of lime, which, when the brick is burned, serves, in combination with the other elements, to give the necessary bond or physical strength. The fineness of the grinding depends upon the nature of the brick to be made. In general one charge, containing material for 200 bricks, will be ground at the rate of approximately four pans per hour for standard 9-inch bricks; while to obtain the fineness requisite for the intricate and difficult shapework necessary in bye-product coke-oven construction, only two pans per hour may be possible. The rock is exceedingly hard; and a comparatively slight increase in the fineness of grind is accompanied by a seemingly disproportionate lowering of the grinding capacity, and an increased wear upon the pans. The difference in the ground rock lies, not so much in the actual size of either the coarse or fine grains, as in the relative proportion of fine. There can be no question that the general effect of increasing the fineness of grind is to improve the abrasive resistance of the brick, and the requirements for typical coke-oven specifications have worked no hardship upon the manufacturer; for the present-day stand of workmanship oven shapes is such as to "carry its own grind with it," if the expression may be used. To secure the accurate filling out of shapes, and the clean-cut accuracy essential, the grind is actually much finer than is necessary to satisfy the usual specifications as to that feature.

Moulding.—The ground silica material when ready to mould is of about the consistency of damp sand, but, probably because of the extreme angularity of its grains, has less flow as it is manipulated. As a consequence, the moulds must be filled by pounding with heavy plank beaters, and all corners and shapes of irregular outline must be rammed by hand, much as sand moulds are made, but with heavier blows. Unequal ramming, which leaves a variation in the density of the green brick, will give unequal expansion in the kiln. It is by no means uncommon to lose hundreds of a difficult shape through such fire-cracking. To get proper moulding and ramming requires the strictest supervision. The wear on the steel moulds is exceptionaly severe; and they are often decidedly complicated and always expensive, as "loose sides" must be used. The moulded silica has almost no strength, and can be taken from the mould only by allowing the sides to come with it, after which the sides are stripped. After moulding, the shapes are placed on pallets and dried, either on a steam-heated hot floor or on rack cars in some form of tunnel dryer. The bricks are then ready to be set in the kilns.

Burning.—The majority of silica bricks are burned with soft coal in the familiar type of round, down-draught kiln. The following schedule of burning may be considered as fairly normal. When the setting is complete and the doors are sealed, fire is immediately started, and continued slowly with slight acceleration for nine to twelve days, during the last two or three of which the final temperature should be practically attained. The kiln is then held at the required temperature—say, at No. 26 cone (1650° C., or 3002° Fahr.)—directly in front of the firebox, for another day, after which the fireboxes may be sealed, and allowed to remain thus for approximately twenty-four hours more. The cooling requires about as long as the burning.

Effect of Burning on Composition and Expansion.—In discussing the desirable qualities of silica bricks, it is frequently said that "all the expansion shall be burned out of them." This brings out the questions: What is the nature of this expansion; what produces it; what is its extent; and how fully can it be controlled? Let it be premised that all silica bricks are made in moulds smaller than the proposed finished or burned brick; and that under the influence of heat a permanent expansion occurs, swelling the brick from the mould or "green" size to the required or "burned" size. It is desirable that this permanent expansion be completed during burning, so as to preclude further permanent expansion when in use. Expansion will occur on heating—a true thermal temporary expansion that will disappear upon cooling, which must not be confused with the permanent expansion produced in the brick during its manufacture. If a silica brick is not properly burned, then, upon re-heating in actual coke-oven use, there will be not only its normal thermal expansion, but an additional permanent expansion. It is essential in the construction of the coke-ovens that the expansion, whatever its nature, be as small as possible, and that, whatever it is to be, it be known and adequately cared for.

It will be recalled that the silica brick under consideration is formed by adding 2 per cent. of lime to quartzite rock of the following composition:

	Per Cent.
Silica (SiO_2)	97·80
Alumina (Al_2O_3)	0·90
Ferric oxide (Fe_2O_3)	0·85
Lime (CaO)	0·10
Magnesia (MgO)	0·15
Alkalies	0·40

The representative silica brick produced may be assumed to have the following composition:

	Per Cent.
Silica (SiO_2)	96·25
Alumina (Al_2O_3)	0·88
Ferric oxide (Fe_2O_3)	0·79
Lime (CaO)	1·80
Magnesia (MgO)	0·14
Alkalies	0·39

What are the changes which occur as the siliceous mass is burned? Certain of them are obvious, such as the formation of a bond of one or more of the lime-silica compounds, such as the meta-silicate CaO,SiO_2 or $2CaO,SiO_2$. With the exception of the lime present, the ferric oxide and the alumina, though small in quantity, are the preponderating impurities, and there is undoubtedly formed a certain amount of silicate of iron as well as compounds of the lime-alumina series. Whereas the lowest melting point incident to any eutectic of the lime-silica system is 1436° C. (2617° Fahr.), and of the alumina-silica series 1610° C. (2930° Fahr.), while that of the lima-alumina system is 1400° C. (2552° Fahr.), some of the eutectics of the ternary system, CaO, Al_2O_3, SiO_2, melt at approximately 1170° C. (2138° Fahr.), and are thus among the first of the flux compounds resulting.

No less important, though less recognized, changes occur in the brick as it is heated. The evidence of this change is seen by the most casual measurement when bricks are drawn from the kiln from time to time, as higher temperatures are reached. The final expansion will be very close to $\frac{3}{8}$ inch per foot. The theory of this expansion is that a change occurs in the crystalline form of the silica—an inversion from the quartz crystal to the crystalline form of crystobalite.

ANALYSIS OF COMMERCIAL BENZOLS.

At the Meeting on Monday last week of the London Section of the Society of Chemical Industry, Mr. Percy E. Spielman described a new method for analyzing commercial benzols.

The author said the name of Mr. Wheeler should have been associated with the paper, the object of which was to describe an easy method of technical valuation—rather than a method to please those dealing in atomic weight—to evaluate the benzene, toluene, paraffin, and carbon bisulphide in a commercial well-washed benzol reaching to about 20 per cent. of toluene. Beyond that, the method would scarcely work. It was assumed (and justifiably so) that commercial benzol consisted primarily of toluene, benzene, paraffin, and carbon bisulphide; the only other constituent being thiophene, which could be ignored as it only made $\frac{1}{2}$ per cent. on the evaluation of the paraffin, while the other substances that were present were really too small to have any effect. The aim had been simplicity; and the method rendered it necessary only to do one distillation and two specific gravities. If the sample was distilled in an ordinary flask up to 90° C., then the quantity which passed over was proportional to the quantity of toluene in the sample. Actually, the quantity that remained in the flask was proportional to it; but by making up an empirical curve, the quantity of toluene could be found in this way. Taking the specific gravity of the sample—after removing the carbon bisulphide, and taking the gravity of the resulting free liquids—the difference between the two gravities was proportional to the quantity of carbon bisulphide. It had already been suggested by other workers that this was so; but he did not know whether it had been used as a direct method of estimation. Knowing the proportions of benzene, it was a simple matter to find the specific gravity of the toluene and the carbon bisulphide. The difference between the specific gravity of the substance after the removal of carbon bisulphide and that of the toluene-benzene mixture was proportional to the amount of paraffin; and that was all it was necessary to do. He and Mr. Wheeler had taken a large number of samples and a large number of known mixtures, and the accuracy had been found to be within 1 per cent.

Dr. Harold G. Colman said he had tested Mr. Spielman's method and found it gave results within the limits he had mentioned, applied to known mixtures of pure materials and carefully carried out. He congratulated Mr. Spielman on having found a quick method for this purpose.

The Chairman (Mr. A. R. Ling), in proposing a vote of thanks to the authors of the paper, congratulated them upon their method, which (unlike many analytical methods) had been confirmed by a well-known expert.

A Jacketed Gas-Burner.

A new Teclu gas-burner was (says "Engineering") described by P. Verbeck in the "Chemiker *Zeitung*" of Dec. 11. It is a bunsen burner, which is provided with two concentric tubes; the air being sucked down through the annular space between the two tubes, and reaching the flame from below in a preheated state. The connection with the rubber tube from the gas-pipe is made, as usual, in the base of the burner; and the orifice of the horizontal gas-inlet tube can be closed more or less by the pointed end of a screw. Into the base is screwed a block, which widens out to a disc. Into this disc and its cylindrical shell the two burner-tubes and other parts are screwed. The block is perforated; and the perforation ends above in the nozzle for the gas-jet. The inner tube and, further out, the outer tube surround this nozzle; and both these tubes are opened-out a little conically at their lower and upper extremities. The air-feed can be adjusted by lowering or raising the outer tube in its screw-fitting. The arrangement is less complicated than it might appear, as all the parts can easily be fitted together. The advantage claimed is that a short, stout flame can be produced, which completely envelops the crucible to be heated; but when a long, narrow flame is desired, a short, straight cylindrical tube is lowered into the inner tube, on the edge of which it rests.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Pitch Problem.

Sir,—To find a use for pitch seems to be apparently a difficulty—and to carbonize it in high-temperature retorts is simply to waste the valuable oils it contains—to say nothing of the good coke it will yield if properly carbonized. Pitch contains from 50 to 54 per cent. of volatile matter, and 28 to 32 per cent. of fixed carbon.

By low-temperature carbonization, approximately $\frac{3}{4}$ gallon of crude (water-free) oils can be obtained per 1 per cent. of volatile in the pitch. These crude oils will fractionate into benzols, phenols, &c., &c.

The trouble which presents itself is the low melting point, which makes it difficult to retort and carbonize; but if any one interested will send 3 tons of pitch to the low-temperature carbonizing works at Battersea which I control, I do not doubt that it can be carbonized economically, and with excellent commercial results.

F. D. Marshall.

19, *Queen Anne's Chambers, Westminster, S.W., March* 11, 1916.

Dyes and High Explosives.

Sir,—Your article, "Dyes and High Explosives—After the War," provides food for thought. In the present international upheaval, the hundred-and-one confronting difficulties of the hour naturally demand additional care; but now one has become reconciled to troublesome matters in gas management.

The principal effort, however, of a gas undertaking is directed to the production and sale of gas at the lowest possible figure, both for public benefit and the security of invested capital. The war, as you point out, offers an opportunity of constructive policy; and one would ask how are such opportunities to be used to the best advantage, and have we done as much in the past as could have been accomplished (say) by better co-operation?

The topic of tar will serve to illustrate the question. Is this commodity only something to be drawn off from the gas-works with the minimum of trouble, and thus cease its connection with gas manufacture, or should a valuable product be worked-up by the industry, and dealt with commercially? A recent movement in the House on this very matter might be accepted as an invitation to commercial application. Tar to coal in ratio being six-and-a-quarter per cent., its parts as we know them under the sliding-scale are:

	Concomitan Part of Tar. Per Cent.	Ratio to Coal. Per Cent.
Pitch	63·22	3·95
Crude naphtha	3·24	0·20
Carbolic	0·96	0·06
Creosote	32·08	2·00
Anthracene	0·50	0·04
	100·00	6·25

Evidently pitch can be carbonized with good result up to 5 per cent. of coal. That would apparently leave a 20 per cent. margin over and above a possible total carbonization. Creosote has calorific properties which might be turned to remunerative account. Only 0·3 per cent. of the total weight of coal remains. The sooner a new tar policy is considered, the better will it be for the gas consumer and proprietor, as well as the advocates of a purer atmosphere.

The call of to-morrow is co-operation—co-operation between the accountant, the chemist, and the engineer, with a representative Association for all matters concerning the industry's important work.

Oikonomia.

March 11, 1916.

The Naphthalene Plant at Bury.

Sir,—I have read with interest the paper on "Naphthalene" that Mr. Simmonds, of Bury, put before the Manchester District Institution of Gas Engineers at their meeting on the 26th ult., and am pleased to notice that he has experienced considerable benefit by spraying naphtha into the gas. I have no doubt that had he not been using the process at the same time that he was washing the gas with tar for the extraction of toluol, &c., he would have had a very bad year for naphthalene stoppages.

I think, however, Mr. Simmonds, in justice to myself, should have mentioned that the apparatus he described in his paper is an exact copy of one he inspected at our Grimesthorpe Gas-Works. On June 27, 1913, Mr. Simmonds wrote asking for a sketch and particulars of my spraying apparatus, to which I replied: "Come over and see it for yourself." He did so on July 2, 1913, and I then gave him all details, showed him the results we had obtained, and the material we were using.

I may say that I designed the apparatus and have had it continuously at work with considerable success since 1905.

Jno. W. Morrison.

Sheffield, March 6, 1916.

Pitch Carbonization.

Sir,—If it were not for loss in memories, there would be great conflict even among ourselves—the present with the past; and people might say, "Here is an industry of great profession, which, after 116 years, has not made up its mind what it is best to do with tar."

We have tried burning tar body and soul for heating retorts. By an accumulation of science, tar is now dissected limb from limb, sinews from veins, tissue from flesh, until (so to speak) there is only left the mummy—pitch.

War has forced us into the exhumation of a "dead horse" in the vainest hope of flogging life into it again, and so many of us remember how, in its vigour of life, it kicked us most severely when it stabled itself in the hydraulic main—its pet stable.

It would be passing an opportunity not to give the benefit of a recent search through the "JOURNAL" anent tar, pitch, and naphthalene.

Following the discussion of "Tar Firing under Retorts" brings us to Jan. 12, 1904, p. 80, when we find an article "The Coming of the Vertical Retort: the Settle-Padfield Vertical Retorts at Exeter." The numerous tests included therein gave "No tar." On March 22, 1904, as the outcome of the Exeter results, Mr. George Helps wrote under the title "Is Tar a Necessity?"

It is interesting and opportune to reproduce the figures of a test made by the late and much lamented Professor Lewes.

Coal Used in Settle-Padfield Verticals—Camerton Slack.

Gas	13,250 cubic feet per ton.
Illuminating power	14·75 candles ("London" Argand No. 1).
Heating value	533·7 B.T.U.
Tar	None.

Same Coal in Horizontal Retorts.

Make per ton—

Gas	9862 cubic feet.
Illuminating power	15 candles.
Tar	10 gallons.

It should be remembered that the Settle-Padfield process only yielded 4 to 6 gallons of tar, which was returned to the retorts in very minute quantities, and in this way was entirely disposed of.

An average of the composition of the gas from tests made by Professor Lewes gave 61·23 per cent. of hydrocarbon content due, he said, "to the large ratio of heating surface to the mass of coal, to getting the best out of the tar vapour, and to the gases not coming in contact with any surface to decompose them."

Having completed the search for all that can be found for and against tar and pitch, the history of naphthalene is so voluminous that one can only draw attention to the various articles—such as that in Jan. 3, 1905, p. 28, "Making Gas Entirely Free from Naphthalene." It is notable that in the many tests of gas from the Exeter verticals there appeared—"Naphthalene, Slight trace," "Naphthalene, None," and with the present systems of verticals, there is still no naphthalene present. Therefore it would appear that gas made in the vertical retorts sent through the mains is worth a whole army of gas fitters outside, with absolutely no need whatever for atomizers, spray solvents, and like remedies, which brings us to the bed-rock, that "Prevention is better than cure."

L. S. T.

March 11, 1916.

Price of Gas at Felixstowe.

SIR,—I notice in your report of our annual meeting you state that "the net cost of the gas sold in 1915 was 3d. per 1000 cubic feet more than in 1914; and seeing that they [the Company] only got 3d. increase, and this on a considerably less output, it was obvious they could not expect to show anything like the profit they usually had." I should point out that the increase in the net cost of the gas sold was 5d. (not 3d.) per 1000 cubic feet, and that the 3d. increase in price was on the last six months of the year only, which the words "and seeing that they only got 3d. increase, and this on a considerably less output" does not seem to make it quite clear.

F. M. PATERNOSTER.

Felixstowe, March 8, 1916.

Mortgage Bonds.

SIR,—I am pleased to be able to give a satisfactory reply to the letter of "Enquirer."

In 1902, the same idea occurred to me, and I communicated with Somerset House. They replied as follows:

> "I am directed by the Board of Inland Revenue to acquaint you that an endorsement under hand for extending or varying a marketable security, such as that in question, is held to be chargeable with the duty of 6d. only, provided that it is executed during the currency of the security."

Of course, I have since acted accordingly.

ACCOUNTANT.

March 9, 1916.

Showroom Reform.

SIR,—May I again trespass on your columns, in reply to the letter from a "Northern Showroom Manager" which appeared in your last issue. In doing so, I would remind your correspondent, firstly, that there are questions involved on all sides in a controversy of this kind.

Apparently fortune has smiled upon him, inasmuch as he has obtained recognition for his abilities. In this respect one must allow he should speak for himself. But, evidently, he is quite in ignorance of how showroom men are treated in another part of the country, which above all should lead in these matters. Our case is that initiative and efficiency are not adequately recognized.

Platitudes uttered by men holding high positions are all very well; but if they are not backed up by action, of what use are they? One cannot live upon them; neither do they encourage one.

He says [referring to Mr. Cyril Davis]: "If we attain to the all-round efficiency which these articles advocate and so ably describe, we shall be able to command a position of dignity and authority, with its accompanying increase of salary." I am sure we are much obliged for the information, and we respectfully commend it to all gas undertakings; for one has there the whole case in a nutshell.

As to the suggestion of an Association, it would be gladly welcomed, provided loyalty to the undertaking would not be impaired.

In conclusion, I take this opportunity as a last word of expressing an earnest hope that, having been able, through the courtesy of the "JOURNAL" to ventilate our views, our claims will receive the kind considerations of the heads of gas undertakings, to the mutual benefit of all concerned.

FAIRPLAY.

March 9, 1916.

[This correspondence may now be considered as closed.—ED. J.G.L.]

REGISTER OF PATENTS.

Delivering and Compressing Gases.

WEGMANN, E., of Wülflingen, Switzerland.

No. 210; Jan. 6, 1915. Convention date, Jan. 6, 1914.

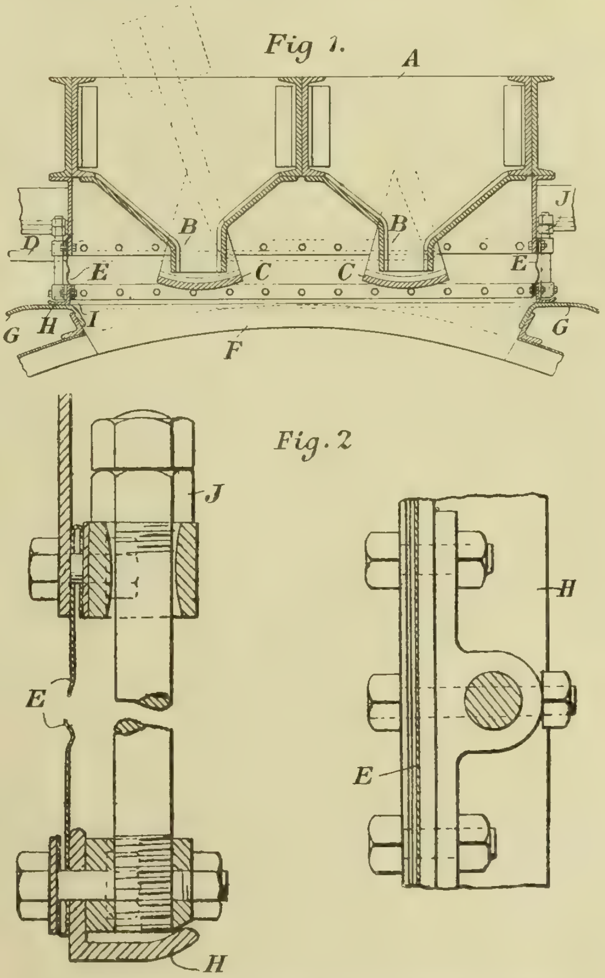
This invention relates to apparatus for delivering and compressing gas by means of a liquid issuing in the form of a jet from a nozzle. To increase the efficiency of such apparatus, a blade wheel is sometimes arranged in front of the nozzle—the wheel being rotated by the issuing jet of liquid, changing the shape and direction of motion of the issuing jet. But according to the present invention, the vane-wheel driven by the issuing jet of liquid is coupled to a fan, which sucks the gas to be delivered, and forces it into the jet of liquid issuing from the vane wheel—an arrangement which is said to produce "increased efficiency, together with a simplification in the construction."

Preventing Escape of Coal Dust during the Discharge of Retorts, &c.

WARNER, A. W., and the RITER-CONLEY MANUFACTURING COMPANY, Allegheny, Pennsylvania, U.S.A.

No. 2693; Feb. 15, 1915.

The present invention is "particularly applicable for use in connection with charging apparatus employed in a gas retort house"—for example, as shown in Patent No. 17,855 of 1912; and in the illustration accompanying the specification there is shown a stationary bin and the upper portion of a coal-hopper on a charging machine designed to travel in front of the retorts and under a stationary storage bin.



Warner's (Riter-Conley Company) Coal-Charging Hopper.

Fig. 1 is a vertical sectional view of a portion of a coal-bin and a portion of the upper end of a coal-hopper designed to be carried on the charging apparatus. Fig. 2 is an enlarged side elevation and part horizontal section, particularly showing a guide-rod and adjusting nuts.

A is a stationary bin having a sloping bottom and coal discharging openings B, controlled by doors or gates C operatively connected with a rod D, moved to open the door by any suitable means (not shown). The stationary bin is provided with depending members which, when assembled and secured to the bin, constitute a rigid rectangular frame. Secured to its lower edges are strips E of suitable flexible material (as strong canvas) the upper edges of which are held between the downwardly depending members and bars secured to the frame by bolts. There is thus constituted "simple and efficient closure means adapted to co-operate with the receptacle into which the material contained in the bin is to be introduced."

F is the hopper receiving coal from the discharge opening of the stationary bin, and designed to be carried on the upper portion of a charging apparatus (not shown). The hopper, or the opening through which the material is introduced to the hopper, is rectangular, and bounded by a mouthpiece G, designed to make contact with the closure means or its lower metallic frame as the charging apparatus carrying the hopper is moved under the bin.

The flanged portions and the mouthpiece are formed so as to provide for an automatic raising of the frame I by the positioning of the hopper below the discharge openings—nuts being adjusted to cause the frame to have its lower position at a point where the co-acting faces of the flanged portions provide a proper meeting without damaging either the frame or hopper. When the hopper passes out of engagement with the frame, the latter returns to its lower position—the nuts J acting to limit the length of such return movement.

By the construction described, the patentees claim to have provided "simple and efficient means for preventing the escape of dust, &c., into the building in which the apparatus is located during the operation of transferring the coal from the stationary bin to the movable hopper.

Gas-Burner Chimney.

Rasch, L., of South Norwood, and Watkinson, F., of Farringdon Road, E.C.

No. 3267; March 1, 1915.

A chimney made in accordance with this invention is provided with a hole (for the purpose of inserting a match, taper, or other lighter) above the mantle, or, in cases where no mantle is employed, the hole is placed just above the burner.

The patentees say they have found that, "by employing a single hole, large enough to receive a lighter, the burner can be lighted without explosions, and with much less risk of damaging the chimney or mantle where employed than is the case with other chimneys;" also, with a chimney of this description, the "combustion is improved."

Controlling the Supply of Gas to Geysers.

Franklin, W. J., of Queen Victoria Street, E.C.

No. 3430; March 3, 1915.

This invention is described (by way of example) in connection with its application to geysers and like apparatus—for controlling the supply of gas and water to them. For this purpose arrangements are provided wherein the gas and water valves are so interconnected that while it is impossible to turn on the gas and light the burner without first partially opening the water-valve, the latter can be subsequently operated to regulate the water flow between certain limits without affecting the gas supply—the final act of turning off the water simultaneously turning off the gas. Interconnection between the valves is effected by means that at one time cause both valves to be operated simultaneously and at another time permit the water-valve to be operated alone, or else to always produce a simultaneous operation of both valves without the gas supply (when once fully turned on) being further affected.

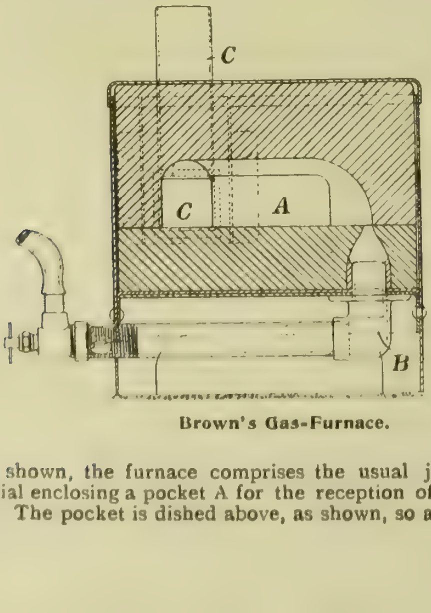
For example, where the gas supply is controlled by a plug cock and the water by a screw-down valve, the latter may be arranged so that its axis is parallel with the axis of the plug and the valve stem and plug be provided with toothed segments (conveniently, quadrants) so arranged that they will be caused to mesh while both valves are closed. By appropriate angular disposition of these segments, it can be ensured that the water-valve shall be opened to a slight extent before the plug is turned sufficiently to permit gas to pass to the burner—both valves opening thereafter in unison until the plug cock is fully open. Then, by reason of the axial displacement of the quadrant upon the stem of the screw-down valve, the latter becomes disengaged from the plug quadrant. But, thereafter, the screw-down valve can be further opened to regulate the water supply without affecting the plug cock and gas supply. Conversely, when the screw-down valve is sufficiently closed, the quadrants will again become engaged, and the gas-valve is caused to close before the water supply is finally arrested.

Gas-Furnaces.

Brown, D. A., of Glasgow.

No. 16,905; Dec. 1, 1915.

This invention relates to furnaces suitable for heating soldering irons and other articles of the type in which the walls only are impinged on by the flame, so that the article is isolated from any influence tending to effect oxidation, while the walls are designed for "thermal storage of the heat energy."



Brown's Gas-Furnace.

As shown, the furnace comprises the usual jacket of refractory material enclosing a pocket A for the reception of (say) the soldering iron. The pocket is dished above, as shown, so as to provide a path for the hot products of combustion and prevent their contact with the article being heated. It is provided with a restricted opening to permit the entrance and withdrawal of the article to be heated. Fitted in the refractory base supporting the jacket is a gas-burner B, the nozzle of which is so arranged that the flame impinges on the inner surface of the jacket without approaching the article to be heated. The jacket is formed with a lateral outlet C for the products of combustion.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for March 8.]

Nos. 2918—3306.

Bradley, A.—"Manufacture of trinitrotoluol." No. 3056.

Keith, G. & J.—"Controlling the mixture supplied to gas-fired furnaces." No. 3181.

Khan, A.—"Shades or screens for lamps." No. 3043.

Rollason, A.—"Increasing heating power of coke." No. 3196.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bills read a second time and committed: Aberdare and Aberaman Gas, Colchester Gas, Ferndale Gas, Hornsey Gas, Imperial Continental Gas, Newcastle-upon-Tyne and Gateshead Gas, Yeadon Water.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bill read a second time: Aberdeen Corporation Water.

The Wakefield Corporation Bill has been referred to the Committee on Unopposed Bills.

Gas Orders Confirmation Bill.

A Bill to confirm certain Provisional Orders made by the Board of Trade under the Gas and Water Works Facilities Act, 1870, relating to Fleetwood Gas and Long Eaton Gas, was presented by Mr. Pretyman last Wednesday, read the first time, and referred to the Examiners of Petitions for Private Bills.

Technical Instruction.

This subject was raised in the House last Wednesday by Sir Philip Magnus, who asked the President of the Board of Education whether, in deciding the amounts of grants to be allocated for technical instruction, he would consider the urgent importance at the present time of maintaining the standard of efficiency of teaching in technical schools.

Mr. H. Lewis replied that the Board were strongly convinced of the importance of maintaining the standard of technical instruction under war conditions, and developing that instruction to the highest possible point as soon as the pressure of external circumstances was reduced.

Daylight Saving Bill and National Economy.

Replying to questions asked in regard to the appointment of a Committee to inquire and report as to whether the proposals of the Daylight Saving Bill if put into operation would result in substantial national economy, the Prime Minister said he did not think there was sufficient reason to appoint a Committee of Inquiry on this subject.

Coal Prices.

Mr. Barnes asked the President of the Board of Trade if he was aware that some owners in Scotland were rendering useless the provisions of the Price of Coal (Limitation) Act, 1915, by making it a condition precedent to coal merchants obtaining supplies of coal that they must contract to pay the existing high prices of coal during the next six months (and in some cases the next ten months) with the alternative that in the event of their refusal to contract no supplies of coal would be given; if he had received letters from coal merchants in Glasgow stating that coal had been offered for sale on the conditions mentioned; and, if so, if he had considered these letters, and did he regard the offers so made as a contravention of the Price of Coal (Limitation) Act, 1915; and, if so, what steps did he propose to take in the matter?

Mr. Runciman said he had received representations on the subject. Where there were no contracts two years ago with which comparison could be made, the determination of the proper price for new contracts presented some difficulties. The whole question was bound up with that of securing supplies, and the best course would be for representatives of the merchants to discuss it with the District Coal and Coke Supplies Committee for Scotland in the first instance.

Mr. Barnes asked whether Mr. Runciman was aware that they declined to do that, and did he know that the Lanarkshire coalowners were stipulating that contracts should be made now instead of at the end of June, and that a letter had been sent to his Department asking for advice on this matter and no reply had yet been received?

Mr. Runciman: I am not aware that they have consulted the District Coal and Coke Supplies Committee for Scotland. My information is that they have not yet done so. If they had done so in the first instance, we should most probably have arrived more rapidly at a solution of the difficulty.

The minutes of the Manchester Corporation Gas Committee show that, at a recent meeting of the Bradford Road Gas-Works Station Sub-Committee, a tender was accepted for the erection of a power-house for electrical plant at the works.

LEGAL INTELLIGENCE.

PROCEDURE IN A CONSPIRACY ACTION.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Monday, March 6.

(*Before Lords Justices* Swinfen Eady *and* Bankes.)

Lamb and Wife v. Walton-on-Thames and Weybridge Gas Company and Others.

This appeal was in connection with an action for conspiracy arising out of a prosecution at the Central Criminal Court, a report of which appeared in the issues of the "Journal" for July 27 and Aug. 3 last.

Mr. Comyns Carr said it was an appeal by the plaintiffs from the order of Mr. Justice Coleridge, made in an action brought to recover damages for alleged conspiracy; and the appeal raised the point as to particulars proper to be ordered in such an action. Lamb was for many years the Secretary of the Walton-on-Thames and Weybridge Gas Company; and a man named Ross was a collector in the employ of the Company. Both were insured by the Guarantee Society—Lamb for a large sum, and Ross for a small amount. It appeared that Ross committed serious defalcations; and Lamb was charged with being implicated in the matter. The Gas Company made claims in respect of each of the guarantee policies; and it was pleaded that the defendants had conspired among themselves that, as a condition of allowing the claim under the policy, the Gas Company should assist the Guarantee Society in obtaining the sum of £500 by wrongfully threatening Lamb that, if he did not hand over this sum, the Gas Company would institute a prosecution for felony, and by wrongfully and falsely representing that, if he did pay the sum and hand over certain securities, the prosecution would not be instituted. It was alleged the Guarantee Society made both the threat and the representation, and obtained from Lamb £193 in money and two policies of life insurance. After the money had been paid, the Gas Company, in spite of the representations made, maliciously prosecuted the plaintiff, who, at the trial, was acquitted. On these pleadings, Master Day had ordered particulars to be given of the conspiracy alleged, giving acts and communications, oral and in writing, of all or any of the defendants, with dates and places of such acts and communications, and, if in writing, identifying the documents. Lamb did not object to give particulars as to the object of the conspiracy, or any overt act done; but the order went beyond this, as it referred to the formation of the conspiracy. He submitted, first, that, on principle, the order ought not to be made at all; and, secondly, that the form of the order was far too stringent. At the trial at the Central Criminal Court, letters were put in; and by obtaining, at some expense, the shorthand notes of the trial, the plaintiffs might dig out some things which would satisfy the order. But it would be oppressive, at the present stage of the case, that the plaintiffs should be put to the expense of giving particulars of things which the defendants were well aware of. It was very unlikely, in a conspiracy action, that the plaintiffs would know how the defendants had conspired. If any order were to be made, he suggested it should be that if the plaintiffs' proposed to rely on any evidence as to specific acts, other than those specifically alleged in the statement of claim, particulars should be given 21 days before the trial; and, in default of so doing, plaintiffs should be precluded from relying on such evidence-in-chief—provided the order did not preclude the plaintiffs from cross-examining the defendants' witnesses for the purpose of proving the allegations.

Mr. W. H. Moresby (for the Gas Company), in support of the order appealed against, contended that the plaintiffs should be ordered to give particulars, as a definite agreement was relied upon. During the criminal trial, it was suggested that Mrs. Lamb, while listening at the keyhole of the Board-room of the Gas Company, overheard a certain conversation; and he had a very shrewd suspicion that this conversation was to be relied upon in support of the charge of conspiracy.

Mr. M'Cardie (for the Guarantee Society) submitted that a plaintiff ought not to be allowed to start such an action without giving particulars showing a *bonâ fide* cause of conspiracy.

Lord Justice Swinfen Eady said there was no ground for saying that the plaintiffs ought not to give particulars with regard to acts as to the formation of the conspiracy, by writings or communications which it was intended to rely upon at the trial. It might be that in the possession of the defendants there were copies of letters upon which the plaintiffs might seek to rely; and if it would assist in establishing the conspiracy, plaintiff ought to have discovery in order to enable him to include the letters in the particulars. Therefore the order for delivery of particulars should be after discovery. The order of the Court below would be varied, and would be that, if the plaintiffs "propose to rely on any specific fact or facts, and on any communication, oral or in writing, other than those specifically alleged, the plaintiffs should within 14 days after discovery deliver to the defendants particulars of such acts, &c., in writing; and, in default of such particulars, should be precluded from relying on them, unless the Judge at the trial should be of opinion that the defendants were under no disadvantage, from not having the particulars." This order would not preclude the plaintiffs from cross-examining the defendants' witnesses for the purpose of proving the allegation. The costs of all parties to the appeal, and in the Court below, would be costs in the action.

The Salford Gas-Works as a Controlled Establishment.—The General Purposes Committee of the Salford Corporation have passed a resolution approving one agreed to earlier by the Gas Committee directing application to be made to the Ministry of Munitions to declare the Corporation gas-works a controlled establishment, under the provisions of section 4 of the Munitions of War Act, 1915, in addition to section 7 of the Act.

MISCELLANEOUS NEWS.

TRIBUNALS AND EXEMPTION APPLICATIONS.

Before the Military Service Act Tribunal at Glasgow, an employee of the Corporation, who appealed, stated that he had a badge and certificate from the Ministry of Munitions. He was employed as chief clerk and meter inspector in the Gas Department. Mr. P. G. Stewart: Could a woman not do the work? We have a lot of women doing work as meter inspectors in Glasgow; and they are doing it very well. The Military Officer said he did not understand how the badge and certificate were granted. They wished to know how the Minister of Munitions granted it. The Applicant: My employers applied for it, I understand. The Military Officer said that workers inside the gas-works were badged; but this man should not have got a certificate. It was agreed to adjourn the appeal for inquiry.

On behalf of the Bury St. Edmunds Gas Company, exemption was sought for two men—one of them a stoker. It was stated that there had been 26 men on the staff; but 11 had left. Total exemption was granted to the applicants so long as they continue in their present employment.

Before the Crook Tribunal, an application was made for the exemption of a plumber in the employment of the Weardale and Consett Water Company. It was stated that the Company had already released nine plumbers, and work generally was behind. If the application failed, and the man was taken, the water supply in the area would be imperilled. The Military Representative said they sympathized with the application; but the need of men for the army was urgent. The application was refused.

The Darlington Military Tribunal last Wednesday granted exemptions for two months in the cases of a couple of clerks in the office of the Weardale and Consett Water Company. The Mayor (Alderman J. G. Harbottle) suggested that the Company should arrange to find women substitutes, which, he said, had been done in many cases by the Darlington Corporation.

Before the local Tribunal, the Stone Gas Company applied for exemption for one of their workmen, on the ground that he performed work in the yard, and it was a certified trade. This was not allowed.

Before the Worthing Tribunal, a firm of contractors applied for exemption of a carter employed in carting coal from the railway station to the gas-works. The military objected, on the ground that if the occupation was a certified one, it was not necessary in the public interest that the man should continue in it. The attention of the Tribunal was directed to the fact that the question to be decided was whether the man was a carman at a coal depôt or wharf in connection with the transport trade. The employer said his firm carted nearly 18,000 tons of coal a year from the railway to the gas-works; and he was also carting toluol from the gas-works for the Government. The contract was with the Gas Company. The Tribunal decided that the occupation was a certified one, and that the applicant came within it.

A conscientious objector who appeared before the Sedgefield Tribunal last Friday said he had given up his employment at a bye-product works because he felt that he was assisting indirectly to take life. They made benzol, then toluol, from which was got picric acid – the basis, he said, of all high explosives. The application was rejected.

Before the Southwark Tribunal last Saturday, Messrs. J. & J. Braddock, gas-meter manufacturers, of 45, Westminster Bridge Road, applied for the absolute exemption of two of their employees who were described as "managers of gas-meters, &c." In a letter they pointed out that the men were absolutely essential to their business, as they were fixing meters in the military huts erected for the soldiers. They were also making drums for explosives. The men were found to be in "certified occupations," and were exempt from service.

Application for exemption was made before the Salisbury City Tribunal on behalf of an assistant manager of the distribution department of the Salisbury Gas Company, for whom Mr. G. Fullford, the Chairman of the Directors, appeared. He said the Company had looked upon themselves as a recruiting department. Of their men, 33 per cent. were with the Colours, and a few weeks ago they gave notice to those employees who had not attested. In the Manager they had an enthusiastic recruiter. They asked for the retention of the services of the applicant on account of his technical knowledge. The military report expressed agreement with conditional exemption so long as the applicant remained in his present employment and the conditions remained the same.

TYNEMOUTH GAS COMPANY.

The Fiftieth Annual Meeting of the Company was held on Monday of last week—Mr. J. B. Williamson, J.P. (the Chairman), presiding.

The Chairman, in moving the adoption of the report and accounts, said that, generally speaking, and after taking into account the abnormal conditions which prevailed during the past year in consequence of the war, the results shown in the balance-sheet must be considered good. After meeting all charges, including interest on debentures and loan account, the net profit was sufficient to pay the statutory dividend of 5 per cent. for the year, and allow the addition of about £300 to the balance of £4914 brought from last year. This left a balance to carry forward of £5214. The revenue from gas was £62,250, against £60,999 in the previous year, an increase of £1251. The increase would have been larger had not the restricted lighting, both public and private, been necessary. The quantity of gas manufactured during the year had been 578,580,000 cubic feet, against 580,352,000 cubic feet in 1914, a decrease of only 1,750,000 cubic feet. This was very satisfactory, and was explained by the fact that, whereas gas for lighting purposes had been seriously reduced, the loss had been compensated for by the increased quantity used in furnaces, in munition factories, and by the increased use of gas for cookers, fires, and other heating apparatus. The price paid for coal during the year had been quite reasonable; and the shareholders would be pleased to know that a favourable contract for all the requirements over the current year had been made. The quantity of coal carbonized was 48,200 tons, against 49,674 tons in the preceding year, a decrease of 1474 tons. The reduction was partly accounted for by the better results obtained in the retort-house, where the gas produced from each ton of coal used had been a record. Residuals had given fairly good results; and on the year's work they were better by £1513. Turning to the expenditure, it would be noticed that coal had cost £1043 less than in the previous year. This was caused by more gas being produced per ton of coal, as already mentioned. Maintenance of works, including repairs and renewals, was very much up. Last year this item was £7579; this year it stood at £10,084. The increase was caused by the higher wages and the war bonus paid to the men, and also to the very great increase in the cost of materials, including renewals of retorts, machinery, &c. This was a department in which it was very difficult to save, as the plant and works must be kept in the highest state of efficiency. The price of goods and materials used in repairs and renewals had advanced 10 to 70 per cent. above pre-war prices. Owing to the war, no extensions or special work had been possible. The Company had lost by death Mr. William Oxley, who had been a Director for eighteen years; and their oldest servant, Mr. Harrison, the Chief Accountant.

After the report had been adopted, the usual dividends were declared, on the ordinary stock at the rate of 5 per cent. per annum, and on the preference stock at 4 per cent. per annum—both less income-tax.

HARROW AND STANMORE GAS COMPANY.

Good Progress in Sales During War Time—A Promising District.

The Ordinary Half-Yearly Meeting of the Company was held yesterday week, at the Westminster Palace Hotel, Victoria Street, S.W.—Mr. ARTHUR F. PHILLIPS in the chair.

The ENGINEER and SECRETARY (Mr. J. L. Chapman) read the notice calling the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN said the proprietors had reason to congratulate themselves on the results of the half year. The capital account showed an expenditure of only £33 on plant, but £637 on new mains, £836 on meters, and £1331 on stoves—together £2838. There was a deduction of £2988 for depreciation of meters, stoves, gasholders, and prepayment services, which reduced the capital expenditure on the termination of the half year by £149, although there was an increase in the gas sold of 7,692,000 cubic feet. The capital expenditure, which the Directors were ever seeking to reduce, was now 15s. 2d. per 1000 cubic feet of gas sold. The Company were fortunate in receiving some of the coal used on favourable contracts made before the war started. While 72 tons more were carbonized, the cost was only £1045 more, or rather less than 2s. 6d. per ton. During the current half year, the full effect of the additional price would have to be borne. The coke used for the manufacture of carburetted water gas showed an increase of £354, because of its enhanced value. The charge for repairs and renewals of mains and services was £3665, against £1761 the previous year—the increase being due to the number of fires and gas-heated water-circulators that had been fixed, and the increased amount written-off for depreciation. The total of the charges under repairs and depreciation of works, mains, services, meters, and fittings and stoves was £10,561, or rather over 1s. 3d. per 1000 cubic feet of gas sold, which indicated that the revenue bore a proper proportion of the expense. The other charges in revenue remained much the same. There were, however, two new amounts—war allowances to employees £286, and war service payments £218, which represented the payments made to dependants of those who had joined the Forces, and amounts reserved for single men, to be given them when they returned at the conclusion of the war. The total expenditure for the half year was £29,874, against £24,170 the previous year. The gas-rental was £27,498, against £24,976 the previous half year—an increase of £2522. Of this increase, £1124 was due to the increase in the sale of gas (which was 4·80 per cent.), and £1397 was from the 2d. increase in the price. The stove and meter rental showed an increase of £301. The receipts for products had gone up from £4411 to £6509—an increase of £2098, due to the higher prices received for coke and sulphate of ammonia. The balance from the revenue account carried to profit and loss was £8017, against £7813 in the corresponding half year. Considering the difficulties there had been to contend with, and that the price of gas was increased only 2d. per 1000 cubic feet, these results might be considered satisfactory. The total quantity of gas sold was 167 million cubic feet. There was an increase in the private consumption of 10,642,000 cubic feet; but a falling-off in public lighting of 2,950,000 cubic feet. After providing £1080 interest on debentures, £7 interest on loans, and £21 for the Red Cross Society, there remained a disposable balance of £12,225. The dividend recommended would absorb £6772, leaving £5452 to be carried forward to next year's account. The works and plant had been maintained in an efficient state. The whole of the Company's employees had carried out their duties satisfactorily. Adequate allowances were made to the dependants of those who had joined the Army. A war bonus was allowed to those continuing in the Company's employ; and a reserve for the single men when they returned. The district supplied by the Company was a most promising one for the future—an immediate suburb of London, intersected with many railways, the development was assured. He moved the adoption of the report and statement of accounts.

Mr. ARTHUR M. PADDON seconded the motion, which was unanimously carried.

Moved by the CHAIRMAN, and seconded by Mr. PADDON, dividends at the rates of 5½ per cent. per annum were declared on the 5 per cent. ordinary stock and 5 per cent. on the preference stock, both less income-tax.

Proposed by the CHAIRMAN, and seconded by Mr. L. ANDREWS, Mr. Paddon was re-elected to his seat at the Board; and, on the motion of Mr. F. R. SMITH, seconded by Mr. ANDREWS, the retiring Auditor Major Charles E. Goddard, M.D) was re-appointed.

The CHAIRMAN, in moving a vote of thanks to the staff and the employees, remarked that both Mr. Chapman and the Superintendent of the works (Mr. Chambers) had had an anxious time. But they had worked well, as had all the staff, in the interests of the Company. The carbonizing had been especially satisfactory, as would be appreciated when he said that the production of gas per ton of coal had been no less than 13,500 cubic feet.

Mr. E. L. BURTON seconded the motion, which was agreed to.

Mr. CHAPMAN, in his reply, said that fortunately the Company had not experienced the great troubles that many others had had; and they were thankful that things had gone along so well for them.

On the proposition of Mr. ANDREWS, seconded by Mr. W. RICHARDS, a cordial vote of thanks was passed to the Chairman and Directors.

The CHAIRMAN, acknowledging the vote on behalf of his colleagues and himself, remarked that the administration of gas undertakings just now caused considerable anxiety. There was the difficulty of getting coal and other materials, and that of carrying on business with so many of the employees in the Army. He was afraid these difficulties were more likely to increase than diminish. He was afraid that people generally—more especially in London—failed to realize the serious position this country was in; and he would like to see a strong determination on the part of everyone to do everything in his power to bring the war to a conclusion. He deplored the extravagance that was witnessed, while people should be helping the country by saving their money. He should also like to see more determination on the part of the men employed in munition works and in collieries to give more of their time to assist the country; as well as an entire absence on the part of everyone to make a good thing out of the war.

HORNSEY GAS COMPANY.

A Sound Position under Adverse Conditions.

The Half-Yearly Ordinary General Meeting of the Company was held on Friday, at No. 5, Great Winchester Street, E.C.—Mr. A. M. PADDON, the Chairman, presiding.

The SECRETARY (Mr. W. E. Roberts) read the notice convening the meeting; and the report and accounts were taken as read.

The CHAIRMAN, on rising, made sympathetic allusion to the death of the late Chairman, Sir Hugh Owen, G.C.B., and spoke of the great services rendered by him to the Company. He added that, in securing so prominent an engineer as Mr. Frank H. Jones to fill the vacancy on the Board, the Directors had acted in the very best interests of the proprietors. Turning to the report, the Chairman said this set forth that there had been a falling-off in the business of the Company, the reasons for which were patent to all. Theirs was a residential district, and one largely occupied by persons of no great affluence; and areas of this kind were affected by the adverse influences of the war to a greater extent than others. Though the accounts were satisfactory, it was pertinent to point out that the full weight of these adverse circumstances had not yet come upon the Company. Looking at the accounts themselves, it would be seen that since 1902, when they obtained important capital powers from Parliament, they had availed themselves but little of these powers. Only about £40,000 had been spent, out of the £160,000 authorized; and of the loan capital there was still £34,000, out of the £40,000, to be issued. The total capital received amounted to £251,563, while £256,406 had been expended; so that they were overspent to the extent of £4843. The figure he had mentioned worked out to £470 per million cubic feet of gas sold per annum. This was a very low figure indeed, considering the size of the undertaking; and it had only been attained by great care and economy in the past. The capital per million possessed a significance which was not always attributed to it; for it determined what share the consumer obtained in the reductions in the price of gas, under the operation of the sliding-scale. In their own case, he thought the consumer received about five-sixths of the benefit. In the six months now under review, £675 had been spent on capital account; but £835 had been written-off for depreciation. In the revenue account, coal, oil, &c., had cost £23 less than a year ago; and they might congratulate themselves on this, were it not for the fact that the decrease in business was accountable for it. There had been spent on repairs and maintenance of works and plant, nearly 5d. per 1000 cubic feet of gas; on mains and service pipes, 1·37d.; on meters, 1·64d.; and on stoves and fittings, 4½d. within a little. These were handsome figures. For insurance, there was an additional charge in respect of this half year of £264, due to the covering of air-craft risks. They had protected themselves so far as was possible. The allowances to dependants of employees on active service, £169, was so small that reference to it was hardly needed. On the other side, as stated in the report. sales of gas had fallen off by 2·2 per cent.; and the proprietors would be thankful that things were no worse. The result was not so bad as it looked, because public lighting had been about halved, and the 6 million cubic feet and more thus lost was roughly the figure of the total falling off. So that on the important part of the business—the supply of private consumers—they had not lost ground. Owing to the increase in the price of gas, the receipts for this alone had gone up £1305. The rise was only 2d., which was not very much, when compared with an increase of something like 60 per cent. in material employed. It was his hope that they would not have to call on the consumer to any greater extent in the future. Residuals altogether realized £507 more; and it would be noticed that for ammoniacal liquor they had received only £509, which was an absolutely inadequate figure to bring to account, and disclosed the invidious position the Company occupied with regard to the treatment of their residuals. For some reason passing his wit, the Company gave up their rights to deal with residual products in 1884; and, of course, they must have lost a tremendous lot of money over this. They were now struggling to recover these rights. Unaccounted-for gas figured at 5·3 per cent. (including 1 per cent. used on the works), which would be regarded as satisfactory. The total receipts were £1685 more, and the expenditure £4270 more; so that the profits were less by £2584. They were thus £1628 short of requirements; but this was not a very important matter, when it was remembered that repair and maintenance charges aggregated over 12½d. per 1000 cubic feet, and each 1d. was equal to nearly £1300. Had they been contented with a normal figure for repairs, there would have been a surplus rather than a deficit. Repairs and maintenance of works included charges amounting to nearly £900 in connection with plant erected at the works partly in replacement and partly to strengthen equipment. As to the future, there was a great deal of cause for anxiety. There was no prospect of doing better with regard to coal. The cessation of the war would, however, he thought, have a very great effect on the supply of oil, which would probably be cheaper. While present conditions existed, every practical economy was being enforced that was consistent with maintaining efficiency and pushing the business as far as possible. He concluded by moving the adoption of the report and accounts.

Mr. A. F. PHILLIPS seconded the motion, which was carried unanimously, without discussion.

The CHAIRMAN proposed, Mr. G. W. CAREY seconded, and it was agreed, that dividends should be paid at the rate of 5 per cent. per annum on the preference stock, 12½ per cent. per annum on the "A" stock, and 9½ per cent. per annum on the consolidated stock—all less income-tax—amounting together to £5870, and leaving £37,406 to be carried forward.

Proposed by Mr. PHILLIPS, and seconded by Mr. CAREY, the retiring Directors (Messrs. J. M. Miles and A. M. Paddon) were re-elected, as also was the retiring Auditor (Mr. H. A. Floate), on the motion of Mr. F. H. PILLEY, seconded by Mr. J. T. WESTCOTT.

The CHAIRMAN proposed a hearty vote of thanks to the Engineer and General Manager (Mr. J. W. Buckley), the Secretary, and the executive officers generally, for their services during the six months. He referred to the trying time that had been experienced, and to the excellent way the whole of their duties were carried out.

Mr. E. L. BURTON seconded the vote, which was heartily passed, and suitably acknowledged by Mr. BUCKLEY.

The meeting was brought to a close with a cordial vote of thanks to the Chairman and Directors, which was accorded on the proposition of Mr. H. MITCHELL, seconded by Mr. K. R. MACKAY.

RICHMOND GAS STOVE AND METER COMPANY, LIMITED.

The Twenty-Fifth Annual General Meeting of the Company was held at Warrington last Thursday, when accounts were submitted showing that the balance standing to the credit of profit and loss account (less debenture interest and contingent reserve, and after providing for depreciation of investments) was £38,111.

The CHAIRMAN (Mr. T. Dwerryhouse), in moving the adoption of the report, said he hoped the shareholders had come to the conclusion that it was a satisfactory one. The year's business had been extremely trying, owing to the continual changes in the prices of materials, to the scarcity of workmen, and to the unrest as regarded wages. He was glad to be able to say that, despite all these drawbacks, the Directors had been in a position to submit a report which would compare favourably with those presented in previous years.

Mr. H. M. THORNTON, in seconding, said the balance-sheet must give the greatest satisfaction to the shareholders. The operations of the year, with its resultant financial success, had further strengthened their already strong position, and would undoubtedly assist them to face in the future the many difficulties which must result from the colossal struggle in which the nation with their allies were now engaged. It was a matter of great satisfaction that their business, both in peace time and in war, was recognized to be of national importance. It was not sufficiently known at the present time that it was from the manufacture of coal gas that many indispensable constituents required by the country to-day were largely obtained; and it was, therefore, a national necessity that coal gas should be used in increasing quantity. This reason alone made it clear that their manufactures were of the greatest importance to the country at the present time; for without the apparatus which they and other gas-stove makers supplied, and the renewal parts required for the maintenance of the several millions of stoves already in use, the present great consumption of gas would not be taking place. It should also be realized that, in assisting the nation by consuming gas for all and every purpose, they were also helping forward that economy in expenditure which was so strongly recommended for all; for with the present price of coal, and the difficulties of getting it, gas was undoubtedly cheaper to use for most purposes. With the present and prospective shortage of domestic and industrial labour, they could realize how helpful and necessary their manufactures were to all who lived and worked within the reach of gas supply. In the short space of time at his disposal it was not possible to survey the whole field of their operations; but he would like to mention briefly the important further developments they had made in the supply of industrial apparatus, particularly gas-furnaces. They were fortunate to lay the foundations of this department long before the war commenced; and by the gradual building up of entirely new and economical types of furnaces, they were ready for the great demand they had since experienced. Another department which had strained their resources of output was that of large cooking apparatus for hospitals and canteens, industrial works, &c.

The resolution was carried, and a dividend, free of income-tax, was declared at the rate of 10 per cent. per annum (less 5 per cent. already paid), and a bonus of 6d. per share.

Mr. JOHN A. RANSOME, replying to a vote of thanks to the staff and officials, said they had had a difficult time; but their men had loyally supported them. Some hundreds had gone to the front; and those who remained had in many cases had to alter their work and arrangements, but had met the alterations and different conditions willingly.

Mr. SLACK, speaking to a vote of thanks to the Chairman, said this was the "Silver Wedding" of the Company—in other words, that it had been in existence for 25 years. During the whole of this time it had made rapid progress; but this progress had never been greater than it had been during the last fourteen years.

STOCKPORT CORPORATION GAS MATTERS.

At the last Meeting of the Stockport Gas Committee, the Engineer (Mr. S. Meunier), reporting upon the question of resetting certain of the inclined retorts during the ensuing summer months ready for next winter, stated that he had been considering the question of replacing these retorts with chambers, in order to increase the capacity; and he submitted a sketch plan of the proposed alteration. The Committee resolved that the question be referred to the Sub Committee appointed to consider the matter of the extension of the carbonizing plant.

At the same meeting, Mr. Meunier reported upon the steps that were being taken by the various producers of sulphate of ammonia with a view to having the restrictions on export licences removed; and upon the advisability of installing a plant to be used in connection with the ammoniacal liquor-stills for the concentration of such liquor. He submitted approximate quotations for a plant. The Committee resolved to defer consideration of the matter to the next meeting.

The Engineer also reported upon the question of an alteration in the matter of deposits on new mains and services being paid by applicants for a supply of gas; the reason being that all borrowings for these purposes had been stopped by the Local Government Board and the Treasury. The Committee resolved that Mr. Meunier be authorized to expend a sum not exceeding £100 out of revenue on such extensions.

FARMERS AND SULPHATE OF AMMONIA.

Reference was made in last week's issue of the "JOURNAL" [p. 546] to a meeting of the West Riding of York War Agricultural Committee, at which there were some criticisms of the price of sulphate of ammonia. The statements then made, and some editorial comments in the "Yorkshire Post," have led to the addressing of a letter to that paper by Mr. Richard Coates, B.Sc. (District Agricultural Adviser to the Sulphate of Ammonia Association), in the course of which he says:

> The farmers' standpoint has been given considerable prominence of late; but perhaps a brief survey of the other point of view would not be out of place.
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> In the first instance, it is not true that farmers, as a body, are opposed to using sulphate of ammonia at its present price. Large quantities are being bought every day by farmers; but, of course, there is a minority who cannot see their way clear to change from their usual methods of manuring, and, like all minorities, they have the faculty of making themselves heard. We remember about five or six years ago sulphate of ammonia was costing us about 12s. a cwt.; and we sold our wheat at from 35s. to 40s. a quarter, and other cereal crops at lower prices. Sulphate of ammonia was then considered to be a profitable "dressing," and there was little or no opposition to this view. Now, with wheat selling at about 60s. a quarter, the same manure is said to be prohibitive at 16s 9d. to 17s. per cwt. Does it sound reasonable? After all, the farmer only need apply 1 cwt. of sulphate of ammonia per acre, and for this may confidently expect an increased yield of at least 6 bushels of wheat per acre. The average increase will no doubt turn out to be even greater. But on this basis his profit would work out thus: Increased yield, 6 bushels at 60s. per quarter, 45s.; cost of sulphate of ammonia (say), 17s.; profit, per acre, 28s. Wheat could fall to 45s. a quarter, which is the guarantee price recommended by Lord Milner's Committee, and the margin would still be larger than it was in 1910.
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> Furthermore, sulphate of ammonia is costing considerably more to produce now than before the war. Competent authorities estimate this increase at £4 5s. a ton; yet we are told that no more should be charged for it. If this is so, surely it is fair to assume that wheat, barley, beef, and mutton should still be selling at pre-war prices. But they are not! If we offered a parcel of nitrate of soda at £12 17s. 6d. a ton to any of the gentlemen who, as farmers, are grumbling about the price of sulphate of ammonia to-day, they would probably snap it up, and think they had a good bargain. Yet at that price their "nitrogen" (which is what they are buying) would cost them the same per unit as it does in sulphate of ammonia at £16 15s. a ton. Only this week, a manure merchant gave me his price for nitrate of soda at over £17 a ton. Taking these facts into consideration, is sulphate of ammonia so prohibitive in price?

THE OPPORTUNITIES OF THE GAS INDUSTRY.

The President of the American Gas Institute for the year 1906 was Mr. B. W. Perkins; and he contributed to last month's issue of the "Gas Institute News" a brief editorial pointing out that the opportunities that were present and not known in 1879—*i.e.*, the year of the "Gas-Electric Scare"—are largely here to-day and need but a slight departure from old and accepted ways to be developed.

He wrote: "In looking over a scrap-book recently an article from the Chicago 'Inter-Ocean' of Dec. 22, 1879, describing Edison's successful demonstration of the incandescent electric light at Menlo Park was found; one of the head lines being 'The Knell of Gas Companies Sounded by the Little Man from New Jersey.' How near this prediction has been verified, the reader can guess. Figures are not at hand to compare the gas business of to-day with that of 1879; but it is safe to say it is many times greater than the difference in population of the two periods. This sets one thinking as to the cause, and to wonder if the same efforts put forth in new directions would not produce the same results at the present time.

"Undoubtedly, the advent of electricity as a competitor was the first real stimulant the industry had. Taking advantage of opportunities that had been overlooked, practising economies in the manufacture and distribution, and giving the public the service they deserved, were others.

"When it is considered that the gas industry has a very active competitor in the field with an invested capital of over $2,000,000,000, it emphasizes what intelligent effort will do. The question arises: 'Have all the opportunities been grasped?' The writer is of opinion they have not. Gas as a domestic fuel has been fairly cultivated, water heating to a less degree, industrial uses still less, and all-the-winter house-heating practically none.

"It is not always expected that gas as a fuel will compete in actual outlay with other fuels; but its additional advantages ought and will get the business. And while it is contrary in a general way to present practices, the example of the electric companies might be followed, by giving a very low rate for certain classes of business.

"Tar generally is considered as a substance for roofing and road building, and brings a price as such. While it is a fact that it is a very valuable product if properly worked up, it should receive the attention of the Institute; for interesting capital for the promotion and establishment of plants in various parts of the country, gas companies might be induced to become stockholders in such a plant."

GAS LIGHTING IN TRAINS.

The Jarrow Railway Accident.

There has been issued from the Railway Department of the Board of Trade the report of Colonel P. G. von Donop on the result of his inquiry into the railway accident which occurred near Jarrow on Dec. 17 last. Reports of evidence at the Board of Trade inquiry, so far as it concerned our readers, appeared in the "JOURNAL" for Dec. 28 last, p. 720, and Jan. 25, p. 216. The following extracts, bearing on the subject of gas lighting for trains, are from Colonel Von Donop's report.

After describing the state of things existing at the time of the accident, Colonel Von Donop says:

All the vehicles of the up train, and, with one exception, all those of the down train, were lighted by means of gas; each vehicle having two, three, or four cylinders housed underneath it, well up into the frame. The following are the details of the gas-cylinders on the three vehicles which were burnt on this occasion, and the condition in which those fittings were found after the accident. The leading vehicle of the up train was fitted with three gas-cylinders—one near its front end and two near its rear end. The front cylinder was knocked off the coach by the force of the collision; and it was found lying under the cab of its engine. It was burst at both ends. One of the rear cylinders was also burst at both ends, and the other was delved in at the bottom, though apparently not broken. All the connections of these cylinders were, however, broken away; and it may be regarded as certain that all the gas from two of these three cylinders escaped before the fire on the coaches broke out. The second vehicle of the up train was fitted with four gas-cylinders—two at either end. They were all intact, except the leading right hand one, which had a connection broken and its straps shifted. The low-pressure pipes were, however, severed in the case of all the cylinders. The leading vehicle of the down train was fitted with three gas-cylinders—two at its leading end and one at its rear end. The two front cylinders were found in good order and in position on the underframe; but the rear one was burst at one end. The pipe connections of all these cylinders were also broken.

Having dealt with his conclusions as to the cause of the accident, Colonel Von Donop reports as follows regarding the fire which broke out after the collision:

It is agreed by all the witnesses that the fire did not break out till some few minutes after the collision occurred, and that it broke out on one of the leading vehicles of the up train; but the witnesses disagree as to whether it originated on the first or on the second vehicle of that train. As, however, it was dark at the time, and as those two vehicles were telescoped together, this difference of opinion is not surprising. The most reliable evidence on this point is given by driver Tolliday, who was travelling as a passenger in the up train, and who, being an expert ambulance man, took a leading part in rescuing the passengers. Tolliday had joined the train at Tyne Dock Station, and had tried to enter one of the three compartments of the leading vehicle; but, finding it crowded, he took a seat in the second compartment from the front of the second vehicle. After the collision, he and the four other passengers in that compartment made their escape through the window, and Tolliday proceeded to the signal-box in order to see that the roads were blocked and to send off telegrams for assistance. He then returned to the scene of the accident, and endeavoured to release some of the passengers from the compartment ahead of the one in which he had been travelling—that is, from the leading compartment of the second vehicle; this compartment having been crushed in by the collision. After obtaining tools from the brake-van he succeeded in rescuing three passengers from that compartment, and while he was working to liberate a fourth, the fire broke out. The first he saw of the fire was a small jet rising from the top of the gas-cylinder under the compartment at which he was at work; and he is quite certain that when he first saw it it was solely a jet of gas. At that time, he states, there was no fire burning on the engine of the up train, or on the leading vehicle of it. He at once sent for extincteurs, and used one of them under the carriage; but though he is well acquainted with their use, he failed to check the fire thereby, and he then saw that the wood-work of the carriage had also caught fire. He then used a second extincteur from the side of the carriage, but still without effect. As the fire was now spreading to the top of the carriage, he got on to the roof and used a third extincteur from that position; but still without any success at all. He then succeeded in rescuing one more passenger from the leading compartment; and it is feared that there were still two passengers left in it. But the heat was then too great for him to be able to do anything more. Tolliday is positive that the leading vehicle, the brake third, caught fire from the second vehicle, and was consumed very rapidly; but it is thought that there was no one alive in that vehicle at the time.

The leading vehicle of the down train appears to have caught fire from the vehicles of the up train, though there is no conclusive evidence on this point. The remaining vehicles of both trains were promptly uncoupled and drawn away. It was not until the fire brigade arrived, about an hour later, that the fire on the three vehicles was finally extinguished.

Another witness, guard Dunlop, who was at the time near the scene of the accident, and who reached the front portion of the train before any of it was on fire, thinks that the fire broke out in the front portion of the leading carriage, and that it seemed to originate from the bottom of it. Guard Taylor, who was in charge of the down train, thought that the fire came from the roof lamps; but as this witness did not see the fire until it was burning fiercely, his evidence as to its origin is not convincing. Brake examiner Redican, who was travelling in a rear vehicle of the up train, went to the front of the train after the collision and assisted in rescuing the passengers. At that time none of the vehicles was on fire. He thinks that the fire originated on the second vehicle; but he cannot say on what part of it.

The evidence appears therefore to point to the fire in this instance having originated with the ignition of a jet of gas which was escaping from one of the gas-cylinders of one of the leading vehicles, that this gas-flame then set light to the wooden upper portion of that vehicle, and that that in turn set light to the inflammable portions of the two other vehicles which were lying near it. It is quite possible that the gas may have been ignited in the first instance by some hot cinders or ashes which fell from one of the engines when it was derailed; but it seems certain that it was the gas which was in some way first ignited, and not the inflammable portions of the vehicles.

There have been a large number of railway accidents during recent years which have been accompanied by fires. In some of these—such as those at Witham, Grantham, Hawes Junction, and Ditton—it was found that the fires had originated with escaping gas; while in others—such as the Aisgill and Gretna accidents—escaping gas was found to have intensified the fires, which had originated otherwise. In this instance, the evidence that the fires originated with gas is more definite than in any previous case; and it furnishes therefore a very conclusive object-lesson as to the additional danger which is caused in the case of an accident by the presence of gas on the train.

The Board of Trade reports on the above-named accidents, and on several others, have included a recommendation that, on the ground of safety, electricity should be adopted for the lighting of trains, in preference to gas; and after each of the Hawes Junction, Ditton, and Aisgill accidents the Board specially addressed all railway companies on the desirability of this being done.

As regards the North-Eastern Railway Company's action in this direction, the Company's representatives state that during the last three years all new passenger vehicles which have been built have been fitted with electric light, and that all which will be built this year will also be so fitted. In Appendix II. is shown a return on the subject, furnished by the Company, and from this it appears that, on Dec. 31 last, out of a total number of 4241 coaches owned or maintained by them, 626 were lighted by electricity. A certain amount of progress is therefore being made as regards the fitting of new stock, though the Company have not undertaken, as several other companies have done, that all their new stock shall be so fitted, nor have any steps been taken by them towards the conversion of the existing gas-lit stock. It is hoped that the occurrence of the fire in connection with this accident may at all events lead the Company to the adoption of a definite decision in favour of electric lighting for all new stock and for the gradual conversion of the gas-lit stock.

Certain recommendations were also made in Board of Trade reports with the view of rendering gas-lit coaches less liable to danger from fire, pending their conversion—*e.g.*, the provision of safety valves, strengthening gas-cylinders and housing them more securely, and the use of non-inflammable material for coaches. The Company state that all these matters have been, and are still, under their consideration. The gas-cylinders are now being more securely housed, and on 334 coaches incandescent lighting has been introduced, with the result that one gas-cylinder suffices for each carriage in lieu of three or four. But the safety valves which have been tried have not been found reliable; and, with the exception of the electrically-propelled stock, practically nothing has been done as regards the use of non-inflammable material. This accident shows that, pending the conversion of the gas-lighted stock, further action in these matters is called for. Such expedients can, however, only be regarded as temporary ones, and not as permanent substitutes for conversion to electricity as recommended above.

The War and Gas Supply.—Some editorial remarks on the subject of popular complaints of bad gas in the "Sanitary Record" conclude with the following sentence, giving expression to a feeling which it is a pleasure to acknowledge: "We hold no brief for the gas supply authorities; but when we find an agitation without reasonable foundation being worked up against an industry that is carrying out a patriotic duty at considerable inconvenience and with slight financial recompense, we consider it our duty in all fairness to put before our readers such facts as are within our knowledge."

Lewes Gas Company.—The past half-year's accounts showed a balance on net revenue account of £4679; and the Directors of the Company recommended dividends for the six months at the rate of 4 per cent. upon the original capital stock, and £2 16s. per cent. upon the additional capital stock—amounting to £994. In making this recommendation, the Directors added their regret that, owing to the largely increased cost of coal and other materials, and the difficulties created by the war, they were unable to propose the usual rates of dividend. At the meeting, when the recommendation was agreed to, the Chairman (Mr. Montague Blaker) said the output of gas had been less, and expenses higher; but upon the whole the accounts could be regarded as fairly satisfactory. Twenty-four of their men had joined the Army.

STOCKPORT GAS-WORKS ARBITRATION.

Union Complaints of Non-Compliance with the Award.

At the last Meeting of the Stockport Town Council, the minutes of the Gas Committee which were submitted for approval showed that further questions had arisen out of the terms of settlement reported in the "Journal" for Jan 11 [p. 99] and Feb. 8 [p. 322]. The Secretary of the Municipal Employees' Association (Mr. P. J. Tevenan) alleged non-compliance by the Committee with the award of Mr. Lynden Macassey, K.C., albeit the Corporation had increased the rates of pay to stokers and to carters since the settlement was arrived at.

The Engineer (Mr. S. Meunier) reported that, in accordance with instructions, he had communicated with the Chief Industrial Commissioner (Sir Geo. Askwith) regarding the following complaints put forward by the Municipal Employees' Association of alleged non-compliance with the award, and had asked for a decision on the points raised: (1) That the blacksmith's strikers were not being paid 29s. 6d. weekly, as arranged. (2) That exhauster men (with reference to whose lately re-arranged terms of wages and work no objection was raised) should be paid 39s. 9d. per week, instead of 5s. 2d. per shift, with time-and-a-half for Sunday; or 38s. 9d. for a seven-shift week. (3) That jointers were not being paid at the rate of 7½d. per hour. (4) The Association also raised the question of a man named Brereton, who was only in receipt of 17s. 6d. per week, and whom they classed as a dining-room attendant; and of three men who acted as watchmen at the Heaton Lane Gas-Works, working 56 hours per week, as against the ordinary 53 hours, for the labourers' wage of 27s. 6d. per week.

Mr. Meunier stated that, with reference to (1), the men are receiving 29s. 6d. per week, which was submitted by him at the time as being the standard rate of the town. Subsequent inquiry, however, appears to point to the fact that local engineering firms have not had a standard rate, and that their pre-war payments varied from 22s. to 27s. per week, to which, by arrangement, has lately been added a war increase of 3s. per week. The Gas Department's pre-war rate was 6d. per hour for a 53-hour week—*i.e.*, 26s. 6d.—to which the 3s. was added, making the present wages 29s. 6d.—a higher rate than is paid by the majority of the local firms. The Manchester standard rate is 29s. per week. (2) The actual arrangement is as follows: Per day, 5s. 2d.; per week, seven shifts, 38s. 9d.; no payment for lost time of any kind, either through sickness or other cause. Floor of engine-house to keep clean, also windows and skylight. When the works are shut-down for eight or sixteen hours, time to be employed in cleaning, gland-packing, &c., which would not be done at an ordinary time. This amount is being paid. No explanation as to how the 39s. 9d. mentioned by Mr. Tevenan is made up was submitted; the sum simply being claimed as the amount agreed upon at the inquiry. (3) We have only one man classed as a jointer; and he is paid the awarded amount when on this work. When, as at present, no mainlaying is going on, he receives 7d. per hour, or ¾d. per hour over labourers' rate, as a handy man. There are two other men who occasionally make joints, and who, when doing so, would receive jointer's pay, but who are at the moment working as labourers, at labourers' rates. (4) At the last settlement for increases in 1912, Brereton's case was agreed to be dealt with as a special one. With regard to watchmen, the three men at Heaton Lane Gas-Works are not quite the usual type of watchmen; to the ordinary duties being added the charge of valves, &c. The work is very light, and takes up little time; but, in consideration of it, the Committee have paid the ordinary labourer's weekly rate, now 27s. 7d. (though for the seven shifts of eight hours, as against the ordinary week of 53 hours), instead of the usual 3s. per night.

The Chief Industrial Commissioners' Department have replied that: (1) Blacksmith's strikers are not included in the award, as no claim was made before Mr. Macassey in respect thereof; and therefore there can be no case of non-compliance with the award. (2) The same answer as in (1) applies to the case of the exhauster-men. (3) In regard to jointers, the only case argued at the hearing was that of a man classed as a jointer; and he should receive the rate awarded—viz., 7½d. per hour—both when he is jointing, and when, for lack of jointing work, he is doing labouring work. No question was raised at the hearing as to the ratings of dining-room attendants or watchmen at the Heaton Lane works or elsewhere; so that the award does not include them.

Arising out of this, the Gas Committee subsequently considered a request of the Association that the men at Heaton Lane Gas-Works who worked 56 hours per week, as compared with 53 by the ordinary labourers, should be paid for the extra three hours; but the Committee declined to interfere with the rate of pay of the dining-room attendant.

The foregoing decision of the Committee having been communicated to the General Secretary of the Association, an acknowledgment was received, stating that the case of the workmen had "been fully and even generously met; and that this would put an end to any further complaint on their side." The General Secretary added: "On behalf of the other sections [of workmen], I must tender to the Committee my sincere thanks; and, taking everything into consideration, the concession granted to the men should make them fully interested in their work and more contented than they have been for many years."

Further Bonus for Manchester Gas-Workers.—On the top of the 2s. per week war bonus granted by the Manchester City Council to workmen earning less than 40s. per week, the Gas Committee have resolved that, subject to the men making full time, all workmen engaged inside the works (other than tradesmen) shall be paid a special war bonus of 3s. per week. Workmen certified as sick or injured, and losing time in consequence, are not to be disqualified thereby. The proposal has been approved by the City Council.

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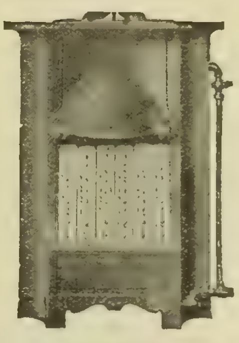

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *March* 13.

The price of pitch remains unchanged; makers' quotation still being 19s. to 19s. 6d. per ton net at works. A certain number of shipments continue to be made, and there seems to be a somewhat better demand in the home market—both for fuel and carbonizing purposes. Solvent naphtha 90-160 is firm at 2s. 2d. to 2s. 3d. per gallon, net and naked; 48-50 anthracene is 2½d. per unit, net, casks included; creosote is steady at 4d. to 4½d. per gallon, net, in bulk, at makers' works.

The position as regards sulphate of ammonia remains unaltered, and export business is practically at a standstill in the absence of export licences. During last month, the quantity exported amounted to 19,895 tons; being a reduction of 12,089 tons as compared with the corresponding month of last year. Prices are quite nominal.

Tar Products in the Provinces.

March 13.

The market for pitch remains unchanged. Creosote is still very weak. Some business is reported in solvent naphtha at slightly lower prices; but heavy naphtha is in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 16s. to 20s. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol. naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2½d. to 2⅝d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *March* 11.

The Government have maintained their policy of refusing to issue licences for the export of this material to neutral countries, and the demand for shipment to British Possessions has not been on a large scale; nor have orders for home consumption been plentiful. The nominal quotations are still £16 17s. 6d. per ton f.o.b. Hull, £17 f.o.b. Liverpool, and £17 5s. f.o.b. Leith, though it is reported that, on the one hand, some producers have realized 2s. 6d. per ton more, while, on the other hand, second-hand sales have been made at 2s. 6d. per ton less money. There is no new feature in the forward position, and buyers and sellers both seem to have adopted a waiting policy for the time being.

Nitrate of Soda.

This market is again dearer on spot, and to-day's prices are 17s. per cwt. for ordinary, and 18s. for refined quality.

Sulphate of Ammonia.

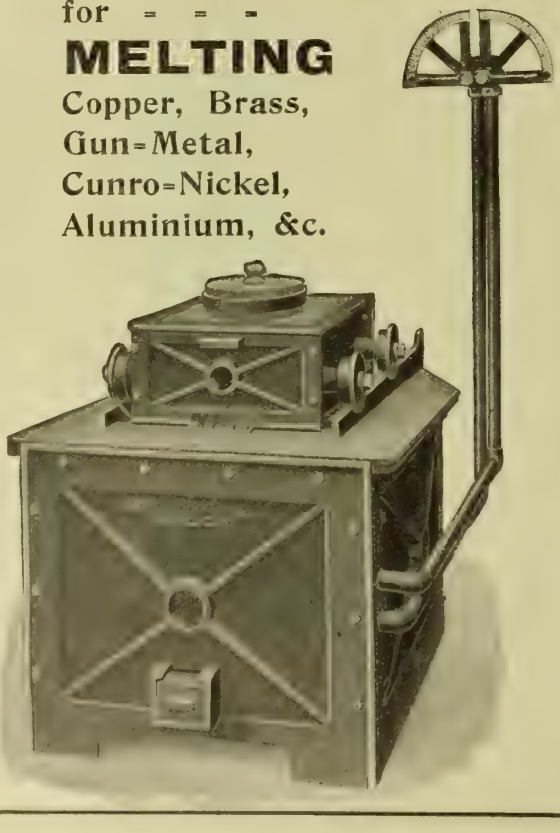
From another source it is reported that outside London makes are quoted at £16; Hull, £16 12s. 6d. to £16 15s.; Liverpool, £16 15s. to £16 17s. 6d.; Leith, £16 17s. 6d.; Middlesbrough, £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

There is quietness in the northern coal trade. This is due largely to the delay of steamers, and the consequent inability to ship coal freely, and very high freights are needed to obtain tonnage. In the steam coal trade, there is fair activity under the circumstances, and the prices are on the whole well maintained. Best Northumbrian steam coals are from 32s. 6d. to 35s. per ton f.o.b.; for second-class steams the quotation is near 29s. per ton; and steam smalls are steady at 15s. to 17s. per ton, with a fair inquiry. The output of steam coals is fairly good, and it is taken up with only the delay occasionally due to the non-arrival of vessels. In the gas coal trade, there seems to be rather more interruption. The current quotations are about 26s. per ton f.o.b. for best Durhams; second-class gas coals are near 24s. per ton f.o.b.; and "Wear Specials" are steady at 27s. per ton f.o.b. For forward delivery, these prices are generally asked, though there are many contracts running at lower figures. The freights continue high, to Italy especially; and one effect has been to reduce the export of gas coal to that country. As high as 96s. per ton has been paid as freight on coal Tyne to Genoa. Very naturally the high costs lessen forward business for export. It is rumoured that considerable purchases have been made of gas coals for one of the great Metropolitan companies, and it is believed that they are on the basis of the Price of Coal (Limitation) Act, but details are not yet given. Coke is steady. Gas coke is in good demand; the price being about 27s. 6d. to 29s. per ton f.o.b. in the Tyne. Shipments of coke from the Tyne this year are about double the quantity sent out in the same period of last year.

Perth Gas-Workers' Wages.—The Perth Gas Committee have had submitted to them the award of Sheriff Mackenzie, of Inverness, which gives the Corporation gas workers an increase of 2s. per week, dating back to last December. The men claimed an advance of 1d., per hour, and the amount awarded to them represents about one-half this sum.



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Oldham Coal Deliveries.

At last Wednesday's meeting of the Oldham Gas Committee, the question of coal supplies for the works was considered at length. Mr. Arthur Andrew (the General Manager) reported that there had been a further decrease in the supplies, as compared with the quantity usually furnished, of nearly 900 tons on the fortnight. Mr. Tim Duxbury (the Engineer) stated that three or four weeks ago they were 15,900 tons behind; and this state of affairs still continued. Contracts which should have started last June or July had not begun delivery yet. A return submitted to the meeting showed that in eleven cases a total of 3870 tons had been delivered in excess of contracts; while on thirteen other contracts they were 16,016 tons short. On one contract for 5500 tons, placed last May, no coal had yet been delivered. Replying to a member, who asked if the Engineer was likely to be seriously inconvenienced by this condition of affairs, Mr. Duxbury replied that for the present he thought they were all right; but for the next winter it would be more difficult. They wanted to have 28,000 to 30,000 tons in stock at the beginning of next October. It was suggested in Mr. Andrew's report that the Committee might consider the advisability of purchasing further supplies, so as to be sure of stocks; and this course was eventually agreed to, if deemed desirable by the Chairman of the Committee (Alderman H. Wilde, J.P.) and the General Manager.

◆

Consumption Maintained at Tonbridge.—Notwithstanding very vigorous restrictions as to lighting, &c., the consumption of gas at Tonbridge was maintained during last year, although the comparison was with a heavy increase in 1914—the highest for many years. Making this statement at the recent annual meeting of the Company, the Chairman (Mr. W. Judd) added that up to Sept. 30 last gas was supplied at the old price; but then an increase of 4d. had to be made, though this left the price at the favourable figure of 2s. 9d. per 1000 cubic feet. Out of 42 men employed by the Company before the war, only seven remained, including one stoker. The dividend, though slightly reduced, had been well earned. There had been a considerable advance in wages for the year, due principally to war bonuses and allowances to dependants of men who had joined the Forces. They had also thought it prudent to insure against air-craft attacks. Such results as were now presented were mainly possible owing to the policy of the Directors of strict economy in the past, and by the erection of the most up-to-date appliances, which had brought the plant to a high state of perfection, of which they were now reaping the advantage. In this connection, he testified to the invaluable assistance they had received from the Manager (Mr. J. Donaldson). The report was adopted, and dividends were declared at the rate of 13½ per cent. per annum on the "A" stock, 10¼ per cent. per annum on the "B," "D," and "E" stocks, and 5 per cent. per annum on the "C" stock, for three months, and 12¼ per cent. per annum on the "A" stock, 9½ per cent. per annum on the "B," "D," and "E" stocks, and 5 per cent. per annum on the "C" stock for three months.

Stretford Gas Company.

Presiding at the half-yearly meeting of the Company, Mr. W. A. Nicholls (the Chairman) said that, considering the period of exceptional difficulty through which all gas undertakings were passing, the working was eminently satisfactory. The balance of £5008 was just over what was necessary to pay the dividends. This result had been brought about by economies and foresight. What the future might be he would not predict. It was gloomy, indeed; but with a balance in hand of undivided profits of over £2500, he had not the slightest doubt that they would weather the next six months without any trouble. The Company had attained their results by advancing the price of gas less than their neighbours—viz., 3d. and 4d. per 1000 cubic feet—and three months later than most of them; so that they had not been unduly hard on their consumers. The figures proved this, as coal and oil had cost £4446 more, whereas the gas-rentals had only increased £2734. They had insured the works against aircraft raids. In connection with the residuals, the outlook for tar and ammonia, owing to restrictions in shipping and exports, was bad; there was no market for pitch; and creosote and sulphate were overflowing the stores. An outlet for some of the pitch could be found on the gas-works. Mixed with coal, it could be carbonized without loss to the Company; and they had been using it for this purpose for over two months. He hoped every gas-works would do the same, and so save the market from further ruin. The Deputy-Chairman (Mr. E. Hibbert), in seconding the adoption of the report and accounts, said that, though the consumption of gas was rather lower than in 1914, there was nothing to be alarmed at. The day consumption had increased all over the district, and on the industrial load alone by over 11,000,000 cubic feet. The numbers of consumers, cookers, fires, and other apparatus were all increasing. The motion was carried, and the usual dividends declared. Replying to a hearty vote of thanks, Mr. H. Kendrick (the Engineer and Manager) and Mr. William Blundell (the Secretary) stated that their efforts would have been unavailing had they not been loyally supported by everyone in their employ, from the youngest boy in the office to the oldest stoker in the retort-house. The shift workmen had worked extra hours doing other duties for weeks past; and so far as the workmen were concerned, they had never had so comfortable a winter.

◆

Employment of Women as Meter-Readers.—The Manchester Gas Committee have decided to engage, on probation, six women as meter-readers, for temporary employment only. This is a purely precautionary measure, in anticipation of some of the regular meter inspectors being required for service with the forces. It has been decided that applicants must be not less than 25 years of age; and, all things being equal, preference is to be given to widows of employees in the department who have lost their lives in the war. The women are to be trained for duties in the suburbs of the city only; warehouses, works, and offices being left to the male employees.

"Progress," wrote an old philosopher, "is the worthiest pursuit of human endeavour."

¶ **The entire facilities of The Davis Gas Stove Co., Ltd.—research, technical, manufacturing, and selling—are dedicated to the progress of Gas—progress based upon a solid foundation of scientific verity.**

¶ **There is nothing altruistic in this, for we believe that whatsoever in our own sphere is for the benefit of Gas, is necessarily of the highest advantage to ourselves and to our clientèle. The justification of our faith lies in the growth of our prestige.**

THE DAVIS GAS STOVE CO., LTD.,
The Gas Exhibition Salons,
60, OXFORD STREET, LONDON, W.

The Fatality at the Derby Gas-Works.

The circumstances of the recent fatal accident at the Litchurch Gas-Works, Derby, were investigated by the Coroner last Tuesday. The victim was James Shaw, a stoker and mechanic, aged 43, who was crushed to death by a machine weighing 3 tons. Deceased was in charge of an appliance driven by electric power; and manipulating the control in the wrong way, he caused it to be overwound, and thus placed out of action. For the purpose of rectifying the mishap, a jack was got into position; and this had raised the machine, when it swayed slightly, and both jack and machine collapsed, pinning Shaw and a man named Fox to the ground. Shaw's death was practically instantaneous; while Fox was found to have had both legs fractured. The evidence disclosed that machines of the type to which the accident occurred had been in use at the works for many years without any previous mishap; but Mr. J. Ferguson Bell (the Engineer and Manager) informed the Coroner that he was arranging with the makers for certain additions which would obviate the possibility of overwinding. The Jury returned a verdict of "Accidental death."

Cowes Gas Undertaking.—At last Wednesday's meeting of the Cowes District Council, it was reported that about a hundred applications had been received for the vacant managership of the gas-works. The tender was accepted of Messrs Drakes Limited, for two patent regenerator furnaces and two beds of eight retorts (in arches provided by the Council), sixteen mouthpieces, for an inclusive sum of £483. It was stated that this was a portion of the scheme for improving the plant at the gas-works which had been sanctioned by the Council. Mr. Richardson said the present plant was not only inadequate for the growing demands of the town, but a great portion of it was obsolete. A similar scheme was recommended in 1907 by the late Mr. E. H. Millard, who pointed out how essential it was to carry out the work. They were not then able to do what was necessary, for reasons which were well known to the members.

Bristol Water-Works Company.—It was reported at the annual meeting of the Company that the revenue for 1915 from water-rates was £170,166, an increase of £4869 when compared with the previous year. The amount available for dividend on the ordinary capital was £81,502; and final dividends were declared at the rates of 8½ per cent. per annum on the ordinary shares, and £5 19s. per cent. per annum on the ordinary stock, leaving £10,245 to be carried forward. The Chairman (Mr. H. N. Abbot) remarked that if the consumption went on increasing as it threatened to do, they would before long have to look out for a further supply, to meet the future needs of the community. There was no doubt that Avonmouth was bound soon to go ahead very fast. The portion of the proceedings relating to the retirement of Mr. A. J. Alexander from the position of Secretary and General Manager, and the appointment of his son, Mr. W. A. D. Alexander, as Secretary, is recorded in the "Personal" column to-day.

Gas, Water, and Electricity Charges at Burnley.

The Burnley Town Council have decided upon an all-round increase for gas, electricity, and water. Inside the borough, the water-rate is to be increased from 5 to 6 per cent., and outside from 7½ to 10 per cent. These new charges will change an estimated loss of £7407 into one of £2709. The charge for gas has been increased from 2s. 3d. to 2s. 6d. per 1000 cubic feet by ordinary meter; while the prepayment meters will give 29 cubic feet, instead of 32 feet, for 1d. The revised charges will turn an estimated loss of £4700 into a profit of £3440. There was some discussion as to the unfair treatment of prepayment consumers, who pay cash-down to the extent of 2s. 10½d. per 1000 cubic feet. Alderman Emmott (the Chairman of the Gas Committee) pointed out that it cost a lot more to collect the money from the prepayment meters. Every householder who had a prepayment meter could have an ordinary one if he wished; but the Committee found that, one after another, ordinary meters were being taken out, and the Committee had to scrap them or convert them at considerable cost. They were not all poor people who had prepayment meters. An amendment that 30 cubic feet be given prepayment meter users for 1d. was defeated.

Increased Prices at Ilkeston.—At a meeting of the Ilkeston Town Council last Tuesday, a recommendation of the Gas Committee, sanctioning another increase of 6d. per 1000 cubic feet in the price of gas, was adopted; the Mayor (Mr. J. A. Macdonald), who is Chairman of the Committee, expressing the hope that it was the last time they would have to come forward with such a proposal. A resolution moved by Mr. Lacey, that the question of the increase should be deferred until the next meeting, was rejected. At the same time, it was decided to increase the price for electricity; the statement being forthcoming from the Mayor that the current had been sold at less than it cost locally, when the expense of management, distribution, &c., was added. He also urged that steps should be taken to provide for the depreciation of plant which was bound to take place.

St. Mary Church Gas-Works.—In his report to the Torquay Town Council last week, Mr. F. Chalmers, the Manager of the St. Mary Church Gas-Works, stated that there had been a gratifying increase in the amount of business during the past year. Notwithstanding the adverse conditions caused by the war, more gas had been sold, and there was a larger number of consumers than in 1914. Difficulty had been experienced in getting supplies of coal and other material, and prices had increased enormously. Benzol could not be obtained now, and other spirit had to be used at a cost double that of a year ago; while coal had gone up from 19s. 9½d. per ton to 27s. Labour had not only increased in cost, but there had been great difficulty in securing men intelligent enough and able to carry on the work. This was a difficulty which was not likely to diminish in the near future. The quantity of gas unaccounted for is being reduced gradually from year to year, and now compares favourably with other undertakings.

HOT WATER

FOR

Hospitals, Barracks, Industrial Requirements, General House Supply, &c.,

BY

PARKINSON'S
"HYDROTHERM"
(Instantaneous Heater).

Can be fitted in any part of the building.
Hot Water is obtained by merely turning on any tap.
Gas is automatically controlled according to the drawing of Hot Water.
No possibility of damage by an unaccustomed user.

THE PARKINSON STOVE COMPANY, LTD.,
Incorporating Maughan's Patent Geyser Co.
(Originators of "Geysers")
BIRMINGHAM and 129, HIGH HOLBORN, LONDON, W.C.

Selling Muslin "Mantles."

Two months' hard labour, and a fine of 10s. or seven days for peddling without a certificate, was the sentence imposed by the Magistrates at the Neath Police Court on a man named Patterson, who was charged with false pretences, by selling imitation gas-mantles. A light was applied in court to one of these articles, when it burned away to practically nothing. Defendant called on shopkeepers, represented the "mantles" as being of good quality, and effected sales. He explained to buyers that "British mantles had no names, but German ones had." When taxed with the offence, he stated that he had made the mantles himself from book muslin. He had tried to make good ones, but had not been successful. The fraud must have been more or less profitable, for the police records revealed a "previous conviction" at Weston-super-Mare, for a similar offence.

Plymouth Gas Company's Bill.—Among the minutes submitted to the Plymouth Town Council at their last meeting was one by the General Purposes Committee on the subject of the Plymouth and Stonehouse Gas Company's Bill. This stated that a Sub-Committee had considered the provisions of the Bill, and a report by Mr. Isaac Carr, the Consulting Engineer, and recommended that the Company be asked not to proceed with the proposals with regard to the substitution of a calorific for the illuminating standard and other clauses dependent thereon.

A Test Case under the Coal Prices (Limitation) Act.—The "Iron and Coal Trades Review" last Saturday, in its review of the coal trade, said: "The shortage of supplies experienced of late has become even more pronounced; and there can be no doubt that but for the Limitation Act prices would have risen sharply. As it is, there are more disputes concerning the interpretation of that Act; and we understand that an important test case, in which the London Society of Coal Merchants will support one of their members who has lodged a complaint against a well-known Midland colliery, is to be heard very shortly in the Commercial Court of the King's Bench Division.

Hastings Electricity Undertaking Loss.—In connection with the estimates for the rates for the ensuing year, the Borough Accountant submitted a report to the Hastings Town Council, in the course of which he stated that the estimated deficiency on the electricity undertaking was £6275. Against this loss, however, must be set the saving on public street lighting. The deficiency, he said, was almost entirely due to the loss to the undertaking caused by the restricted lighting orders; the price of coal being only a minor contributory cause. Mr. Mannington, in moving the adoption of the estimates, remarked that it cost them £772 more to have darkness than it did to have light. He feared the electricity deficiency would be more, through economy in light.. Mr. Chesterfield pointed out that there had been a saving of £1289 on gas lighting.

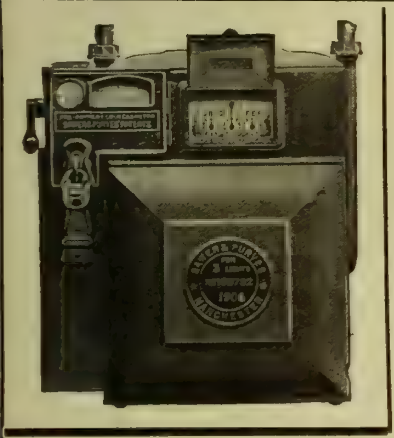
Too Much Light from a Gas-Works.

Summoned under the Defence of the Realm Act for permitting a certain fire to show which might serve as a guide for enemy aircraft, Mr. James Ratcliffe, the Manager of the Alford (Lincs.) Gas-Works, was fined 20s. It was stated that at about 11 o'clock one night, there was a blaze of light for a quarter-of-an-hour from the gas-works chimney. When the police called attention to the matter, defendant explained that the blaze was due to an engine stopping, and could not be prevented. Mr. W. H. Mainwaring (the Manager of the Lincoln Gas-Works) gave evidence to the effect that if a gas-engine suddenly stopped, the flare could not be prevented. The stopping would not necessarily be a sign of neglect, as the attendant might have other duties to perform. Mr. Ratcliffe, who pleaded "Not guilty," pointed out that labour was difficult to secure; and the man in charge of the exhauster engine had to do stoking. It was while thus engaged that the engine stopped—an occurrence which it was at times impossible to prevent—thus allowing the gas to escape, and causing the flare.

Effect of the Lighting Restrictions at Shotley Bridge.—The annual meeting of the Shotley Bridge and Consett Gas Company was held on Friday last—Mr. G. Ainsworth, J.P., the Chairman, presiding. The Directors' report stated that the receipts amounted to £17,831, and the expenditure to £13,879; leaving a profit balance of £3951. After the payment of interest on loans and the interim dividend, a dividend of 5 per cent. per annum, less income-tax, was recommended. The sale of gas showed a slight decrease, which was due to the lighting restrictions. The report was adopted.

High Wycombe Gas Supply.—The operations of the High Wycombe Gaslight and Coke Company, Limited, for the half year to Dec. 31 resulted in a profit of £1333, to which had to be added a sum of £2703 brought forward, and £95 bank interest. After payment of debenture interest, preference dividend, and dividends at the rates per annum of 10 per cent. on the original shares and 7 per cent. on the additional shares, there will remain a balance of £2739 to carry forward. The concrete tank for a new gasholder has been completed; and it is hoped that the holder will be erected by the end of June.

Ulster Gas Undertakings.—At a meeting of the Newtownards Urban Council, it was stated that the Gas Committee had agreed to contribute a sum of £240 towards the relief of the rates. The Cookstown Urban Council have reduced the general town rate from 5s. 10d. to 5s. 8d., as a result of the saving effected by reduced public lighting. The Lisburn Urban Council have resolved to increase the price of gas from 3s. 8d. to 4s. per 1000 cubic feet. The Coleraine Urban Council have acknowledged their indebtedness to the assistance given by the Gas Managers of Ballymena and Portrush, and by local merchants, to enable them to maintain the gas supply, which was threatened by coal shortage—due largely to delay of steamers.



The "Positive"

"THE METER OF MANY MERITS."

SAWER & PURVES, BRANCH OF METERS LTD.

MILES PLATTING,
MANCHESTER.

RADFORD ROAD,
NOTTINGHAM.

Agent for Scotland: JNO. D. GIBSON, 2, CAUSEYSIDE STREET, PAISLEY.

Increased Water Charges at St. Helens.—Estimates for the ensuing year, showing that on last year's basis there would be a deficiency of £3500, were considered by the St. Helens Water Committee a few days ago. Last year there was a deficiency of £2400, almost entirely due to the increased cost of coal, &c. It was decided to increase the charge for domestic supplies from 6 to 7 per cent. on the gross rental, and the charge for metered supplies from 7d. to 8d. per 1000 gallons. These increases, it is calculated, will bring in £4200 extra.

Electricity from Waste Heat.—A dividend of 8 per cent. for the past year was declared at the ninth annual meeting of the Waste Heat and Gas Electrical Generating Stations, Limited, which was held last week; and a sum of £500 was voted to war relief funds, to be allocated at the discretion of the Board. It was stated that the total capital expenditure up to Jan. 31 (the end of the Company's financial year) had been £277,649. The profit earned in the twelve months amounted to £39,819, which was an increase of £817 over the previous year. After payment of the dividend, there will be a balance of £17,430 to be carried forward. Last year £1000 was voted to different relief funds in connection with the war.

Sunderland Gas Company.—In moving the adoption of the report and accounts at the annual meeting of the Company, the Mayor (Alderman Stansfield Richardson), who is Chairman, said the accounts for the year ended Dec. 31 showed a profit of £23,590, as compared with £22,237 in 1914, and £25,144 in 1913. He paid a tribute to the work of the Directors and the staff in overcoming the immense difficulties placed before them. Despite all the troubles, he said, they had been able to declare the maximum dividend for the year; and they had made no advance in the price of gas. At the present time, upwards of 40 per cent. of the employees had joined the Colours; and practically all of those remaining who were of military age had attested under Lord Derby's scheme. They had done their best to fill the vacant positions with female labour; and the Company were very well satisfied with the work women were doing. With regard to the allowance to dependants, they had paid a sum of £1682. Owing to the lighting restrictions, the consumption of gas showed a decrease of 2¼ per cent. He concluded by moving that a dividend of 5 per cent. be declared on the original stock and 4¼ per cent. on the additional capital stock, less income-tax. This was carried unanimously.

STOCK MARKET REPORT.

Business on the Stock Exchange was more than quiet. It is a common, and often a misused, expression to speak of something as "unprecedented;" but last week the term was by general consent held fairly applicable to the state of things in the House. There was no pronounced factor of depression at work—in fact, the trade returns were favourable. But the public showed no disposition to take any step at all, much less any risks. There were slight movements from time to time in some markets, as each happened to be swayed by internal influences. In Government issues, the War Loan and Consols rather weakened about midweek; but later on they effected a recovery. Until it is possible to know something about the new loan that is to be, they are not likely to show much activity. Home Rails were almost inanimate, and movements were slight and irregular. In Americans, there was a little improvement. Canadians were better, but only moderately so, considering the progressive prosperity of the country. The Foreign Market generally was weaker, and the notably strong spots there recently apparent failed to hold their ground. The French loan was easier for a day or two, but steadied subsequently. Japanese fell when deprived of Government support; but Chinese was in good demand. Things in South America seem to be looking up. South Africans were rather firmer. In the Miscellaneous Market, movements were somewhat irregular. Rubber and oil had a dull fit now and then, and copper was not at its best. In the Money Market, rates both for short loans and for discount hardened. The Government sales of Treasury Bills and Bonds were good. Among other topics of interest, the question of a War Loan issue of Bonus Bonds containing an element of prize-winning upon redemption was much discussed; and the principle received influential support as being likely to prove highly popular. In the House the Anti-German agitation is materializing, and elections on to the Committee will be influenced by it. Business in the Gas Market was moderate and devoid of any marked characteristic. Record prices were the same as the preceding week, with at most only fractional variation here and there.

Bargains done for cash during the week were as follows: On Monday, Bournemouth "B" 11⅝, European 12¼, 12⅜, $12\frac{7}{16}$, Imperial Continental 63¼, Primitiva $2\frac{1}{16}$, 2¼, ditto preference $3\frac{9}{16}$, 3⅝, South Metropolitan 75½, 75¾, 76, Tottenham "B" 92, 92½. On Tuesday, Bournemouth "B" $11\frac{13}{16}$, Gas Light ordinary 72¼, 72¾, 73, Imperial Continental 60½, ditto debenture 64½, 65, Primitiva $2\frac{3}{16}$, South Metropolitan 75, 75½. On Wednesday, European 12¼, Gas Light ordinary 72¼, 72½, 72¾, Primitiva debenture 83, 83¼, ditto (1911) 62¼, 62½, South Metropolitan 76. On Thursday, Cape Town 1⅜, Gas Light ordinary 72⅜, $72\frac{7}{16}$, 72½, 72⅝, ditto preference 74¾, 75, 75¼, Imperial Continental 60½, 61, Primitiva $2\frac{3}{16}$, ditto preference 72s., 72s. 6d. On Friday, Alliance and Dublin 62, Cape Town debenture 65, Commercial 3½ per cent. 69¾, 69½, European 12⅜, $12\frac{7}{16}$, Gas Light ordinary, 72, 72¼, 72⅜, $72\frac{9}{16}$, 72½, 72⅝, 72¾, ditto preference 74½, 74⅝, 75, Primitiva 2¼, ditto preference 72s. 6d., 73s. 9d., South Metropolitan 75⅝, 76. On Saturday, Gas Light ordinary 72¼, 72½, ditto preference, 74⅛, 74⅜, ditto debenture 60, South Metropolitan 76.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	62
874,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
333,110	10	"	7	7/-	Bournemouth Gas and Water B 7 p.c.	15—15½	4 10 4	11⅝—$11\frac{13}{16}$
115,000	10	"	6	6/-	Bournemouth Gas and Water Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	Bournemouth Gas and Water 4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
734,920	"	"	†11	55/-	Do. New	204—209	5 5 3	..
55,000	"	"	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	"	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	1⅜
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	65
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,518,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	"	"	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	69¼—69½
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800,000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200,000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	5¾	Derby Con. Stk.	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	12¼—$12\frac{7}{16}$
16,327,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	72—73
2,600,000	"	"	3½	3½	Gas Light and Coke 3½ p.c. max.	76—79	4 8 7	..
4,062,235	"	"	4	4	Gas Light and Coke 4 p.c. Con. Pref.	96—99	4 0 10	74⅛—75¼
4,674,850	"	June 11	3	3	Gas Light and Coke 3 p.c. Con. Deb.	72½—74½	4 0 6	60
130,000	"	"	10	10	Gas Light and Coke 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
181,000	Stk.	Mar. 12	7⅞	7¼	Ilford A and C	151—154	5 2 4	..
65,780	"	"	6⅜	5⅞	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	60½—63¼
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	64½—65
235,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A B	211—213 146—148	4 13 11 4 14 7	..
806,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,875,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅝	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 3	..
100,000	50	"	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	"	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 13 4	$2\frac{1}{16}$—2¼
499,960	5	June 26	5	2/6	" 5 p.c. Pref.	4¾—5	5 0 0	71/3—73/9
521,600	100	June 2	4	4	" 4 p.c. Deb.	91—93	4 6 0	83—83¼
—	—	—	—	4	" " " 1911	..	—	62¼—62½
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	"	"	10	10	Do. B	222—224	4 9 3	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,603,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75—76
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	135—138	5 8 8	..
782,275	"	"	6	6	Tottenham District B 3½ p.c.	115—117	5 2 7	92—92½
181,255	"	June 26	4	4	Tottenham District 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/8	55/1½	" C 3½ p.c.	110—115	5 9 0	..
352,000	"	"	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	"	"	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

* Ex. Div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

The total weight of cast-iron pipes and fittings imported into all seaports of British India in the fiscal year 1914-15 was 27,021 tons from the United Kingdom, 794 tons from Germany, 107 tons from Belgium, and 11,814 tons from the United States. The declared value was £415,664—a decrease of £97,330 on the previous year.

The Swansea Gas Company announce the sale by tender of £20,000 of 5 per cent. ordinary stock, offers for which must be received by them on or before the 18th inst. It is pointed out that, despite drastic public and domestic economies in gas consumption during 1915, the total sales of gas increased; and the business in other directions has expanded and developed to an exceptional extent. Therefore to meet requirements in the near future the Directors have found it necessary to provide for additional manufacturing plant which will increase the producing capacity of the works by over 20 per cent. The stock is not offered generally but only to existing stockholders, gas consumers, and the local public.

It is reported that one of the iron and steel companies that have done very well during the past year is Messrs. Stewarts and Lloyds, Limited, of Glasgow and Birmingham. The full profit figures are not yet available; but after setting aside £100,000 for depreciation, and making provision for contingencies under the Munitions of War and Finance Acts, the Directors will recommend the payment of the fixed dividend of 10 per cent. on the preferred ordinary shares and also a distribution of 2s. and a bonus of 6d. per share on the deferred shares. Then £60,000 is to be placed to general reserve, £20,000 to the employees' benefit reserve, and £100,000 is carried forward. The distribution on the deferred shares equals 12½ per cent., and compares with 10 per cent. in 1914. The amount written off for depreciation that year was the same as now; but only £50,000 was placed to general reserve and £10,000 to the employees' benefit fund—£97,666 being carried forward. Apparently, therefore, after providing for all special war taxation, including the excess profits duty, the available earnings showed an increase of more than £30,000.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Manager (Coke-Ovens). Yorkshire Coking and Chemical Company, 11 and 12, Pall Mall, S.W.
Gas and Water Engineer and Manager. Tyldesley Urban District Council. Applications by March 20.
Gas and Water Engineer. Leigh (Lancs.) Corporation. Applications by March 23.
Manager (Warehouses). No. 302, Smith's Advertising Agency.
Assistant. Ilfracombe Gas Company.
Supervising Foreman. Nechells Gas-Works, Birmingham.
Carbonizing Foreman. No. 6163.
Gas and Water Fitters. Winchester Water and Gas Company.
Main and Service Layer. Todmorden Gas Department.

Meeting.

British Gaslight Company. 11, George Yard, Lombard Street, E.C. March 29. Twelve o'clock.

TENDERS FOR

Coal.

Darlington Gas Department. Tenders by March 23.
Liverpool Gas Company. Tenders by March 20.
Maidstone Gas Company. Tenders by March 22.

General Stores (Sulphuric Acid, Lead Tubing, Barrows, Rakes, Taps, Locks, Slot Fittings, Oils, Benzol, &c.).

Pontypridd Gas Department. Tenders by March 28.

Lighting Goods (Lamps, Incandescent Materials).

Pontypridd Gas Department. Tenders by March 28.

Meters.

Pontypridd Gas Department. Tenders by March 28.

Cookers.

Pontypridd Gas Department. Tenders by March 28.

Pipes, &c.

Pontypridd Gas Department. Tenders by March 28.

Tar and Liquor.

Cockermouth Gas Department. Tenders by March 27.
Marple Gas Department. Tenders by March 21.
Pontypridd Gas Department. Tenders by March 28.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 23s. 6d.; Half Year, 12s.; Quarter, 6s. 6d. Payable in advance. If credit is taken, an extra charge of 4s. a year is made.

Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to
Walter King, 11, Bolt Court, Fleet Street, London, E.C.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
Palmerston House,
Old Broad Street, London, E.C.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
Andrew Stephenson, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

ALDER AND MACKAY
(Established 1850).
WET AND DRY METERS.
SLOT AND ORDINARY.
STREET LAMPS AND AUTOMATIC CONTROLLERS.
EDINBURGH.

R. & G. HISLOP,
GAS ENGINEERS, RETORT BUILDERS, CONTRACTORS, &c.
RETORT SETTINGS, COAL TESTING PLANT, BOILER FIRING.
Communications should be addressed to
Underwood House, PAISLEY.

SULPHURIC ACID.

SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated Wm. Pearce & Sons, Ltd.,
36, Mark Lane, London, E.C. Works—Silvertown.
Telegrams—"Hydrochloric, Fen. London."
Telephone—1588 Avenue (8 lines).

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, Oldham, and 45 & 47, Westminster Bridge Road, London, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
Repairs receive prompt attention.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"Braddock, Oldham," and "Metrique, Lamb London."

SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—
BALE AND HARDY,
39, Victoria Street, Westminster, S.W.

MEWBURN, ELLIS, AND PRYOR.
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent London." 'Phone: 243 Holborn.
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Feb. 22, p. 440.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS.
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "Dacolight London." Telephone: 2336 Holborn.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the Enrichment of Gas.
Manufactured and Supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agents, F. J. Nicol & Co., Pilgrim House, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

OXIDE OF IRON.
We are in a position to Supply Oxide of Iron promptly, and invite Enquiries.
SPENT OXIDE WANTED.
BALE & CHURCH, LTD.
5, Crooked Lane, London, E.C.

"TORTO" FIRE CEMENT.
BALE & CHURCH, LTD.
5, Crooked Lane, London, E.C.

"KLEENOFF," THE COOKER CLEANSER.
Tins for sale to Consumers.
In Bulk for Works Use.
BALE & CHURCH, LTD.
5, Crooked Lane, London, E.C.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
Joseph Taylor and Co., Central Plumbing Works, Bolton.
Telegrams—"Saturators Bolton." Telephone 0848.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

CANNOCK, HEDNESFORD, AND DISTRICT GAS COMPANY, LIMITED.
APPLICANTS for the Position of WORKS ENGINEER and MANAGER for above Company are THANKED, and informed that AN APPOINTMENT HAS NOW BEEN MADE.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every Description of GAS APPARATUS, ELEVATING, CONVEYING, and TELPHERAGE PLANTS, also STOKING MACHINERY, ROSE MOUNT IRONWORKS, ELLAND.

TYLDESLEY-WITH-SHAKERLEY URBAN DISTRICT COUNCIL.

APPOINTMENT OF GAS AND WATER ENGINEER AND MANAGER.

THE above Council invite Applications for the Post of ENGINEER and MANAGER of the Gas and Water Departments from persons with Practical Experience in a similar capacity.

Salary, £200 per Annum.

The person appointed will be required to Reside in the District and Devote his Whole Time to the Duties.

Applications, on the Official Form, which may be obtained on receipt of Stamped Addressed Envelope from the undersigned, must be Delivered at the Council Offices on or before the 20th inst.

Canvassing in any form will bar appointment.

By order,
W. J. MATTHEWS,
Clerk to the Council.

Council Offices,
Tyldesley, March 8, 1916.

THOROUGHLY Competent Manager Required to Superintend Bye-Product Coke-Works (Koppers' System) at Castleford. No person resident more than 10 miles from the Advertisers' Works, or already engaged on Government Work, will be engaged.

Apply, stating Age, Experience, Qualifications, and References, to the YORKSHIRE COKING AND CHEMICAL COMPANY, LIMITED, 11 and 12, Pall Mall, LONDON, S.W.

MANAGER for Warehouses, Packing, and Despatch Departments, to Supervise Final Testing of finished Gas Apparatus, Control Workpeople and Warehouse, and Office Staff. Systematic and Capable Organizer. Commencing Salary, £200.

Box 302, SMITH'S AGENCY, LIMITED, 100, FLEET STREET, E.C.

ILFRACOMBE GAS COMPANY.

WANTED—A Capable Assistant for the Works of the above Company.

Full Particulars of Duties, &c., can be obtained from J. ARMSTRONG, General Manager.

BOROUGH OF LEIGH.

APPOINTMENT OF GAS AND WATER ENGINEER.

THE Corporation of Leigh invite Applications for the Position of GAS AND WATER ENGINEER for the Borough.

Salary, £350 per Annum, increasing by annual increments of £50 (subject to approved service) to a maximum of £450.

Candidates, in addition to the Ordinary Duties of Gas and Water Engineer, must be Competent to Design and Supervise the Construction of New Works, Additions, or Extensions to Existing Works.

The person Appointed will be required to Devote the Whole of his Time to the Duties of the Office, and Reside within the Borough.

Applications, accompanied by *copies* of not more than three Testimonials of recent date, and endorsed "Gas and Water Engineer," must be Delivered to me not later than the 23rd inst.

Canvassing members of the Council will be a Disqualification.

W. H. COWBURN,
Town Clerk.

Town Hall, Leigh (Lancs.),
March 11, 1916.

WANTED, for large Yorkshire Gas-Works, a CARBONIZING FOREMAN. Must have had Experience with Stoking Machinery, Telpher Plant, &c., and be able to Control Workmen. Wages, £2 10s. per Week.

Applications, by letter, stating Age and Experience, to be sent to No. 6163, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

CITY OF BIRMINGHAM.
(GAS DEPARTMENT.)

A THOROUGHLY Capable and Ex-perienced SUPERVISING FOREMAN required for the Nechells Works of the above. Applicants must be Experienced in all Modern Methods of Gas Manufacture, and fully Capable of Supervising men.

Particulars may be obtained from the ENGINEER, Nechells Gas-Works, BIRMINGHAM, to whom Applications with Testimonials must be addressed.

TODMORDEN CORPORATION.
(GAS DEPARTMENT.)

WANTED—A Main and Service Layer, Ineligible for Military Service.

Apply, by letter, stating Age, Experience, and enclosing *copies* of Testimonials, to the MANAGER, Gas Department, TODMORDEN.

WANTED—Gas and Water Fitters, Ineligible for Military Service.

Apply, by letter, stating Age, Experience, and enclosing *Copies* of Testimonials, to the WINCHESTER WATER AND GAS COMPANY, 19, Staple Garden, WINCHESTER.

GASHOLDER and Iron or Steel Tank WANTED, of about 40,000 to 60,000 Cubic Feet capacity, for Re-Erection.

State Price, &c., to No. 6159, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

PURIFIERS Wanted—Set of Purifiers from 15 to 25 feet Square. Preferably Dry, Luteless Covers.

Address, No. 6160, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

WANTED—Good, Clean, and Hard CARBON, in Four-Ton Lots, or more, f.o.r.

Address, No. 6072, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

PONTYPRIDD URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE above Council invite Tenders for the Supply of the following STORES and MATERIALS required for the Year ending March 31, 1917:—

No. 1.—GAS-COOKERS.
No. 2 —SULPHURIC ACID.
No. 3.—HORSE FEED.
No. 4.—STREET LANTERNS.
No. 6.—W.I. TUBES and FITTINGS.
No. 7.—LEAD and COMPO TUBINGS.
No. 8.—BARROWS, RAKE HEADS, &c.
No. 9.—OILS and BENZOL.
No. 10.—INCANDESCENT MATERIALS.
No. 11.—SLOT FITTINGS.
No. 12 —METERS.
No. 13.—MAIN TAPS and LOCKS.
No. 14.—CAST-IRON MAINS and SPECIALS.

Forms of Tender and Conditions may be obtained on Application to Mr. E. H. Swain, Engineer, Gas-Works, Treforest, Pontypridd.

Tenders on the Prescribed Forms, Sealed and Endorsed "Tenders for Gas Stores No. —" (as the case may be), must be received by the undersigned on or before Tuesday, March 28, 1916.

The Council do not bind themselves to accept the lowest or any Tender.

J. COLENSO JONES,
Clerk to the Council.

Municipal Buildings,
Pontypridd, March 10, 1916.

PONTYPRIDD URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE above Council invite Tenders for the Purchase of the Surplus COAL-GAS TAR and WATER-GAS TAR produced at their Treforest Works during the Year ending March 31, 1917.

The Tar will be Delivered into the Purchaser's Railway Tank-Waggons at the Treforest Gas-Works Siding.

Forms of Tender and Conditions may be obtained on Application to Mr. E. H. Swain, Engineer, Gas-Works, Treforest, Pontypridd.

Tenders on the Prescribed Forms, Sealed and Endorsed "Surplus Tar," must be received by the undersigned on or before Tuesday, March 28, 1916.

The Council do not bind themselves to accept the highest or any Tender.

J. COLENSO JONES,
Clerk to the Council.

Municipal Buildings,
Pontypridd, March 10, 1916.

MARPLE URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TAR AND LIQUOR.

THE Gas Committee of the above Council invite TENDERS for the Purchase of surplus TAR and AMMONIACAL LIQUOR produced at the Gas-Works during the Year ending March 31, 1917.

The Tar and Ammoniacal Liquor will be required to be taken Direct from the Works by the Purchaser.

Contractors must Tender on their own Forms.

Tenders, endorsed "Tar and Liquor," and addressed to the Chairman of the Gas Committee, Council Offices, Marple, must be Delivered not later than four o'clock p.m. on Tuesday, the 21st inst.

J. W. RAMSBOTTOM,
Clerk to the Council.

Council Offices, Marple,
Cheshire, March 11, 1916.

COCKERMOUTH URBAN DISTRICT COUNCIL.

THE Gas Committee of the above Coun-cil are prepared to receive TENDERS for the Purchase of Surplus TAR (about 170 tons) produced from the 1st of April, 1916, to the 31st of March, 1917; also stock (about 80 tons) at present on hand for Immediate Removal.

Price to be f.o.r. in Contractor's own Tank-Waggons at Cockermouth.

Any other Particulars required from the undersigned, to whom Tenders should be Delivered on or before Monday, the 27th of March, 1916.

A. F. YOUNG,
Manager and Secretary.

Gas-Works, Cockermouth.

LIVERPOOL GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the Liverpool Gas Company are prepared to receive TENDERS for the Supply of 50,000 Tons of COAL, to be Delivered at the various Works of the Company during the period of Three Months between the 1st of April, 1916, and the 30th of June, 1916.

Tenders will be received for the whole or any portion of the above quantity.

The Directors reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

Full Particulars and Printed Forms of Tender can be obtained on Application to the undersigned, at the Gas Office, Duke Street, Liverpool.

Sealed Tenders (on the Printed Form only), addressed to the Chairman of the Company, must be Delivered at or before 10 a.m. on Monday, the 20th of March, 1916, endorsed "Tender for Coal."

R. E. GIBSON,
Engineer.

Gas Office, Duke Street,
Liverpool, March 8, 1916.

MAIDSTONE GAS COMPANY.

THE Directors of the Maidstone Gas Company invite TENDERS for the Supply of 16,000 Tons of Unscreened Durham GAS COALS Delivered in Barge alongside their Wharf on the Medway, Maidstone, over the Thirteen Months commencing June 1, 1916.

The Directors also invite TENDERS for 10 000 Tons of Screened Yorks GAS COALS or Washed Yorkshire NUTS Delivered at Maidstone West Station over the same period.

Any further Particulars required can be obtained from the undersigned, to whom Tenders should be Delivered not later than March 22.

The Directors do not bind themselves to accept the lowest or any Tender.

FRANK LIVESEY,
Engineer and Manager.

Maidstone, March 9, 1916.

COUNTY BOROUGH OF DARLINGTON.
(GAS-WORKS DEPARTMENT.)

TENDERS FOR GAS COALS.

THE Corporation of Darlington invite TENDERS for their requirements of Freshly-Wrought GAS COALS, Delivered to the Gas-Works Sidings as required during the ensuing Twelve Months.

Further Particulars and Form of Tenders may be obtained from Mr. Frank P. Tarratt, Gas-Works Engineer, Darlington.

Tenders, endorsed "Tender for Gas Coals," to be Delivered at my Office, Houndgate, Darlington, not later than the first post on Thursday, March 23, 1916.

No pledge is given that the lowest or any Tender will be accepted.

HY. G. STEAVENSON,
Town Clerk.

Town Clerk's Office,
Darlington, March 6, 1916.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Chief Office of the Company, No. 11, George Yard, Lombard Street, in the City of London, on Wednesday, the 29th day of March, at Twelve o'clock precisely, to Transact the usual Business, and to declare a Dividend for the Half Year ended the 31st of December last.

NOTICE IS HEREBY ALSO GIVEN that the TRANSFER BOOKS of the Company WILL BE CLOSED on the 18th inst., and RE-OPENED on the 30th inst.

By order of the Court of Directors,
A. W. BROOKES,
Secretary.

Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.,
March 9, 1916.

PATENTS.—Handbook of Patent Law, by W. P. THOMPSON, F.C.S., M.I.Mech.E., C.P.A., International Patent Agent, 6, Lord Street, Liverpool, and Bradford and London. 16th Edition 1915, 242 pages. 2s. 6d. Post free. English Portion, 6d. "A useful guide to inventors. The subject is treated in a simple and concise manner."—JOURNAL OF GAS LIGHTING.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at THE MART, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 37, WALBROOK, E.C.

"CAPTIVE FIRE"
System
Of Burning Gaseous Fuel.

Particulars of the System were given in Advertisements appearing in the "JOURNAL" for May 25 and June 1 and 8 (pp. 471, 525, 596).

For further Particulars apply to

A. C. IONIDES, 34 Porchester Terrace, London, W.

JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST, LONDON.

VOL. CXXXIII., No. 2758.] TUESDAY, MARCH 21, 1916. [68TH YEAR.

EDITORIAL NOTES.

Exemption of Gas Workers—Improved Outlook.

THE aspect of this question has improved since last we were writing upon it [*ante*, p. 572]; and there was room for improvement. Through the instrumentality of the Institution of Gas Engineers, the British Commercial Gas Association, and the Society of British Gas Industries, the powerful influence of Lord Moulton, Chairman of the High Explosives Committee, has been enlisted in support of the case of the gas industry in making an appeal to the Committee on Reserved Occupations. Lord Moulton, through his work in connection with the High Explosives Committee, fully appreciates that the production of benzol and toluol and other requisites to the war is inseparable from gas makes and gas sales—that all three things are interdependent. This is what we are afraid some other Departments and Committees influential in other matters affecting the war do not know; and this is where the support of Lord Moulton in regard to the representations of the industry respecting its indispensable men will be of immense value. The industry does not desire preferential treatment; it only asks that its power of serving the country and the community shall not be diminished by depriving it of men positively necessary to its work—in both the manufacturing and distributing departments.

However, while Lord Moulton recognizes the necessity of men to the maintenance and extension of the sales of gas in order to enlarge the source of the production of essentials to the making of explosives, he also feels that there is, in this matter of men, an obligation resting upon the industry; and he impressed upon the deputation from the three gas organizations that the principle that should govern the administrators of gas undertakings is not expressed by the question, "How many men can we gain exemption for?" but "How "many men can we spare for the forces of the country?" The representatives of the industry assured Lord Moulton that everything possible will be done by gas undertakings to release eligible men for service, and that to this end in all suitable occupations women will be employed, and in other occupations (in which special skill and knowledge are not necessary) men above military age, where they can be obtained. The appeal that is being made to the Committee on Reserved Occupations is to the effect that reserved gas men for exemption should be extended from "all workmen "inside the works" to "all men essential to the manufac-"ture and the distribution of gas"—wherever it is impossible to replace them by men not of military age or by women. With Lord Moulton's aid, and in view of the position of the industry in relation to the position of explosives, there ought to be no difficulty in realizing this extension, with due recognition of the principle as to the industry sparing, and not trying to gain exemption for, all the men it can.

Other kindred matters were also discussed with Lord Moulton; and in relation to certain of them the interest and assistance of the Ministry of Munitions have been secured. Where a local tribunal will not grant relief to men of military age who are indispensable to an undertaking recovering substances for making high explosives, an urgent special appeal should be made to the Ministry of Munitions, giving full details of the case, and asking for their assistance. Any attempt, too, to unbadge men badged by the Ministry of Munitions will also be resisted by the Ministry, if such men are indispensable to the undertakings employing them.

This information portrays a distinct improvement in the matter of exemption, which has been so considerably worrying those responsible for the work of the industry. But while there is powerful support behind the industry, and cogent arguments to advance in favour of every indispensable man being retained within it, there is nothing definite settled yet. Of course, the Ministry of Munitions cannot interfere with the work of the Committee on Reserved Occupations. The Ministry can advise and support representations; and such advice and support must go a very long way.

Current Work and Future Reward.

ON taking up his presidential duties last Thursday, the members of the Southern District Association of Gas Engineers and Managers gave a welcome to Mr. W. Doig Gibb which unmistakably expressed the depth of friendship existing between them and him, and the general pleasure it gave to see him occupying the chief place of honour in their midst. Although he has emerged from official life into the unfettered region of a consulting engineer, official life with him has such proximity that he can sympathize fully and sincerely with colleagues in the pursuit to-day of their official duties along the roughest road ever experienced by the gas profession, while his work in connection with the High Explosives Department of the Ministry of Munitions gives him a clearer insight than anyone outside can possibly possess as to how, in major part, the gas profession, despite the intractable commercial and working conditions with which its members are surrounded, has added, and is adding, to the current excess of daily duty by working for the country in the production of benzol and toluol. Whatever may betide in the time succeeding the war, there will be confidence, by those with investment in gas undertakings, in the officials who have steered their operations through the severe difficulties of these much-troubled days. And this confidence would be suitably marked by following the advice of Mr. Gibb, towards the close of the address, that the proper reward for the work in these times of the engineer and manager should not be overlooked. Gas engineers and managers are not bound by the service-limiting laws of trade unions, as are most of the rank-and-file of gas-workers; but a conscientious discharge of duty demands from them as much time and ability as are necessary to safeguard and promote the interests in every particular of their undertakings. Time and ability are at present being drawn upon to overflowing measure, but, just as in the case of the workmen, the claims upon the income of the engineer and manager are greater than ever they were. These are matters that should not escape notice in the right quarters.

For the main subject-matter for his address, Mr. Gibb "selected a few problems, present and future." The choice of a "few" was advisable; for if he had dealt with all the current problems that obsess the gas engineer in his wakeful hours, he would have had to convert the bright, practical, and apposite address to which the members listened into something that would have been long, and, through its length, probably less bright and less suitable. Men who are living with difficulties all day long, find conference on them most useful; but they also, when in professional meeting assembled, experience some relief by having their attention diverted to subjects, though of industrial interest, of a more congenial character. That is the line Mr. Gibb took. He drew from the experiences gained in the High Explosives Department the material for comment and advice in connection with the work of extracting from gas the maximum possible quantities, within rational limits, of benzol and toluol. At the same time, he dwelt more upon current problems than future ones. On the principle that sufficient for the day is the work thereof, there has not been much consideration given as to the effect that current problems and conditions will have upon the industry's future. If the President had permitted himself to travel beyond the confines he set, he would have found much more to say as to how current problems affecting coal, transport, labour, residuals, &c., the demands for the raw materials for producing synthetic dyes, and other things will all have material bearing prospectively upon the industry. But limiting himself to the patriotic work that is being done, he is convinced that it is not going without its reward. We are happy to hear this. The reward at the moment is not of a very tangible order; it is really little more than the consciousness of having loyally performed a duty which only the circumstance of position thrust upon the industry.

However, the President is quite of opinion that the sacrifices gas undertakings are making at the present time will result in future in great benefit to them. We hope that the view is correct. The form he foresees it taking is expressed in the words: "With all this good work to their "credit, gas undertakings must be better recognized and "more generously treated by the Government than they "have been in the past." The gas industry itself, and the best of expert experience within it, have hitherto hesitated at the threshold of the broader operations and the larger service which a fresh step in gas treatment would offer. But where there was refusal to advance in the past, national necessity, through the war, has had effect, and has in the result created a new basis upon which to test and decide the question of the requirements of consumers of gas under present methods of its utilization. This should (as the President suggests) serve well in discussing in future with Parliamentary Committees the advisability of granting some standard which will enable consumers to be more efficiently supplied with gas on the most economical basis. In addition, it must be as obvious to our legislators as to those engaged in the work of making our country prosperous through industrial activity and expansion, that, under the conditions which the war has imposed, and which will have effect for many a year to come, no industry must leave undone anything that can be done to benefit its economy and efficiency—more particularly through its own internal resources.

This latter point especially applies to the development by the gas industry of its residual products, with the view to making the utmost of them to help to lighten the higher costs, and more arduous working conditions, which have fallen upon it through the war. The necessity for making the industry the principal source of primary ingredients for the production of high explosives for the prosecution of the war, is the best possible answer to the incipient work in nullifying, or partially so, the considered judgment of the Joint Committee of both Houses of Parliament on Gas Residual Products. The Committee saw that the economic interests of the gas industry, and therefore of the country in this respect, would best be served by maintaining open markets for residual products through the existence within the industry of the power of utilizing them to the greatest advantage. But they and no one else then foresaw how the gas undertakings of the country would, through their residual products, be of such dominant importance as they have been in a European war. Partial or complete tar distillation has been variously adopted solely through the need for the rapid provision of benzol and toluol; and from this there are likely to be developments in the way of joint distillation plants for groups of the smaller undertakings. One lesson of the war is that the extension of the number, and the greater distribution, of such plants, constitute a valuable asset to this country in times of both peace and war—in peace, in view of the extensive needs of the country for aniline dyes and colours. If ever there is further objection to the gas industry developing its own resources in the way that is considered prudent and best, there will be some evidence of a totally new character to adduce not only as to the national advantages of perfect liberty in this matter, but as to certain relationships of tar distillers and those producers who have been tar-washing their gas, and so have substantially improved the value of the tar.

The larger part of the address was not devoted to these subjects; they were only incidental to the discussion of the washing of gas for increasing the available benzol and toluol. In view of the urgent requirement for more benzol, the President made the point that it is highly desirable that administrators of gas-works should now consider whether they cannot go beyond the stage of tar-washing, and wash with oil. Of course, the scale of working is a factor in determining justification for doing this; and by those interested particulars as to what is recommended in this regard can be obtained from the sources mentioned in the address. Of course, this means the further impoverishment of the gas; but this would not matter much if carburetting oil was not so dear and scarce. That is a present drawback. Dehydrating plants and the naphthalene difficulty were among the other subjects. Concerning the latter, the President, judging from the accumulated evidence, considers that the revival of the trouble is due to the tar-washed gas (of lower vapour tension) picking up naphthalene already in the mains, and depositing it again in the smaller and presumably cooler service-pipes. In dealing with the various remedies which have been proposed and applied, the President alluded to the process of injecting into the gas atomized oil. He is of opinion that the use of air for the purpose is a retrograde step, or at any rate unnecessary, seeing that with a small gas-compressor gas could be used as the atomizing medium. Mentioning the accumulation of pitch stocks, the possibility of utilizing pitch for the firing of furnaces is submitted. On these and other points, many practical suggestions are offered; and this reference to them, we are sure, will induce gas engineers throughout the country to read the address from beginning to end. The time spent in its perusal will be amply repaid.

Carbonizing Results from Southampton.

The principal thing that the paper proved which Mr. F. Durkin read at the meeting of the Southern Association last Thursday, is that the Southampton Gas Company did not move a day too soon in determining, in 1912, to supersede their ancient carbonizing plant and practices by modern and approved ones. The figures included in the contribution show what a very fine investment for the Company the change has been; and we should fancy that, as these figures are weighed, there must exist regrets that steps were not taken earlier to secure the advantages. But certain it is, now that there has been proof of what has long since been almost generally recognized as a fact in the gas industry—that following ancient carbonizing practices means continuation of waste, and modern practices substantial economy—Southampton will not again fall away so far to the rear of development. Mr. Durkin and the Directors of the Company are to be congratulated upon the demonstrated success of their long-deferred enterprise.

Handworked circular retorts formerly existed; one house a few years ago was fitted with De Brouwer charging and discharging machinery. The new house is equipped with horizontal retorts, which are worked by a Fiddes-Aldridge discharger-charger, and both coal and coke are handled by a telpherage system. With hand-charging, the retort-house labour costs were equal to 5d. per 1000 cubic feet; while with machine working in the new house, the cost is down to 1·21d. per 1000 cubic feet—a clear gain of 3·79d. per 1000 cubic feet. On the make per ton of coal, this 3·79d. represents a substantial sum, and multiplied by the tons of coal carbonized in the house during a year, the result (to meet capital, maintenance, and other charges) must be a startling one to the Directors of the Company. The money saving in labour is not the only advantage effected. With direct firing, the fuel used was upwards of 30 per cent. of the coke made; it is only about half this quantity now. Another notable achievement is found in the gas make and quality. Durham coals are used; they are designated in Mr. Durkin's reply to the discussion. Approximately the same coals were carbonized when a test was made with the new plant in July, 1914, as when tests were made with it in May and October, 1915. But in the first test only 12,000 feet of gas of 12½-candle power and 510 B.Th.U. gross were made per ton. In the May and October tests, the make was up to 14,500 cubic feet of 12·4 and 13 candle power, and 508 and 510 B.Th.U. gross. It is noteworthy that (assuming the same coal) the make of gas was raised by 2500 cubic feet, without interference with the calorific quality, and with the October test actually showing an increase of illuminating power. The difference in the calorific power results per ton of coal carbonized, through the increased make of 2500 cubic feet, is the advance from 6,120,000 to 7,395,000 B.Th.U. This, Mr. Botley pointed out in the discussion, is a remarkable showing.

These figures are no doubt partly due to the arrangements which Mr. Durkin has adopted for controlling both quality and make per ton. One point as to the coke breeze. It is found that this is rather high, through two causes—the dropping of the coke from the retorts into the telpher skip, and the immersion for quenching purposes of the still incandescent material in the outside water-tank. We pointed to this immersion being the cause of fracturing and breaking-down of coke in the early days of the installation of the telpher on gas-works. But, excepting at Liverpool, there seems to have been little or no attempt at surmounting the disadvantage. Makers of telpher plants should look into the matter a little more closely. Regarding Mr. Durkin's remarks as to vertical retorts, we need not say anything; seeing that the President (Mr. W. Doig Gibb), in the discussion, indicated that it was rather late in the day to speak as though experience with verticals had not yet been thoroughly established.

Block Concrete Purifiers.

THERE is a threatened change coming over the construction of purifier boxes. A growing disposition is apparent to build them of concrete instead of cast iron—mainly on account of cost. But in work of this kind, care has to be exercised as to conditions; and all the experience that is available is needed, so that development may have the advantage of it, and proceed on lines free from the dangers and defects already disclosed. Of course, purifier making is not the same thing as many other constructional operations on a gas-works in which concrete can be, and is, usefully employed. It is not the same even as the building of a water-tight tank; the boxes must be not only water-tight, but absolutely gas-tight. The subject was raised at the meeting of the Southern District Association in a paper prepared by Mr. W. D. Child, in which he described a set of concrete purifiers which he built for the Romford Gas Company, and which were first brought into service nearly two years ago. Economy was the chief consideration with Mr. Child, so long as he could get gas-tight boxes; and seeing that purifiers nowadays can, by proper working method, be made to run for such long periods without changing, he preferred the saving, to be effected by ground construction, of permanent capital charges to the saving of a very occasional additional charge involved through labour in the operation of changing the purifiers. There are two things, however, that Mr. Child did in the construction of his concrete boxes which do not meet with the approval of other engineers who have been making a study of the matter. Against their disapproval, however, is the fact that the Romford boxes have now been running for close upon two years; and, so far as is known, nothing untoward has developed in connection with them.

The two points over which there is disapproval are these: Mr. Child made an excavation, and built his boxes in the ground. He used concrete blocks as the main part of the structure, backing them with 9 inches of massed concrete, and surfacing the inside with "Ironite" so as to ensure gas-tightness. While concrete blocks are found to answer admirably for some constructions, in a purifier-box with gas under pressure the fewer the joints the better; the greater the number of joints, the greater the risk of leakage. Mr. A. A. Johnston, of Brentford, pointed this out in the discussion; and the President (Mr. W. Doig Gibb) and Mr. A. E. Broadberry, of Tottenham, concurred with his view that reinforced concrete is preferable, owing to its higher gas-resisting property. Even with reinforced concrete for purifiers, there is need for warning. Mr. Johnston learned the lesson by experience. It is that the work of building up the concrete must go on continuously to the finish so as to avoid weakness at the point of the amalgamation of the layers through intermittency in the work. There is a weakness at the joint when there is an appreciable lapse of time between the putting-in of one layer and the next; and this was for a time a source of difficulty at Brentford. Through the monolithic character of properly constructed reinforced concrete work, it is certain to have greater favour for purifiers (it is going to be employed for a set of large-scale elevated boxes at Tottenham) than block concrete as adopted by Mr. Child, and which gives his work uniqueness so far as purifier building is concerned.

The objection to sinking concrete purifiers into the ground is that, if there is leakage, being buried in this way, the fault will be very difficult to trace, even if observed; and to repair any defect, this could only be done when the boxes are empty. On the other hand, if the boxes are built so that their exteriors are exposed, leakage, with the gas under pressure inside, would be more easily traced. Upon this point, Mr. Broadberry lays considerable stress; and there will be very general agreement with him. There is the point as to dealing with the concrete on account of its porosity to gas. As already mentioned, Mr. Child has surfaced his boxes internally with "Ironite;" Mr. Broadberry is a great believer in the substance, from his previous experience of it for other purposes. He is going to use it on the inside of his reinforced concrete purifiers. But his own assistant (Mr. J. Fisher) asks, assuming gas-tightness with the purifiers new, is this condition going to be maintained? This question only time can answer. But we see no reason why not, seeing that Mr. Johnston does not find (and we do not understand that he used "Ironite" for internal surfacing) any trouble; and Mr. Child, with jointed blocks, does not report any difficulty. But Mr. Samuel Glover is rather concerned over the question as to whether with the "Ironite," the reactions that proceed in a purifier will not cause the preparation to perish, and render it ineffective in preventing leakage. But all these points must be determined by experience, without which development in economical construction would not be possible.

One other matter. Mr. Child in his paper gives, in detail, the costs involved in the construction of his boxes; and these will be very useful. But working them out, Mr. Johnston finds that they average 3s. 5d. per cube foot; while, for his own larger boxes, with reinforced concrete work, the cost came out to 1s. 7d. per cube foot, against 2s. for cast-iron boxes built on the ground. Mr. Johnston's 1s. 7d. and 2s. are, we take it, for a corresponding time; but whether the time compares, in point of values of material and labour, with Mr. Child's is not known. But a considerable part of the difference between the costs for the block concrete work at Romford and the reinforced concrete work at Brentford is due to the dissimilarity in the dimensions of the vessels. The whole subject of the use of concrete for purifier-boxes is an interesting one; and there is certainty that we shall hear more concerning it—the line of development being, it is fairly clear, by reinforced concrete rather than by concrete blocks.

Sulphate of Ammonia Exports to France.

THERE is such a thing as level-handed justice; but the fact seems to have temporarily escaped the attention of the Board of Agriculture. They have, in much that has been done regarding the reservation of supplies of sulphate of ammonia for home use, had negotiations with the Sulphate of Ammonia Association—the only recognized central body representing the bulk of the sulphate of ammonia produced in the United Kingdom. But now the Board have chosen the irregular course of going behind the back of the Association, and communicating direct with a few manufacturers who are overburdened with stocks of sulphate of ammonia, leading them to hope that licences for export to France will be granted. Other producers have not received the letter; and therefore the question, Why this preferential treatment, when the manufacturers have previously all been put into the same boat by the action of the Board, in their desire to mollify a certain section of the British farmers who were agitating for the total stoppage of the export of sulphate of ammonia, ostensibly in order that they might have an abundance at their disposal, but who have now shown that their action was simply a ruse to, if at all possible, pull down the price? They have not succeeded in this; and they have not absorbed the production. Hence the muddle in which the manufacturers find themselves, combined with the increasing shortage of tonnage, even if licences to export were granted. The letter of the Board of Agriculture to a few manufacturers is anyway (and more so assuming availability of tonnage for export) unfair to others who have also burdensome stocks. It is likewise unjust to those French buyers who had, before the stoppage of licences, made contracts at lower prices than those ruling to-day, and who have now a right, if ships are available, to receive consignments under those contracts, and not be mulct owing to a condition of things created largely through the Board of Agriculture lending a too ready ear to a number of discontented farmers. It is obvious that the correct order of procedure would be to first issue export licences to those who have already contracts with French buyers, and then to make the issue general. It will be seen from a communication published in another column, that Mr. D. Milne Watson, the Chairman of the Sulphate of Ammonia Association, advises makers to take action, in alternative ways, depending upon whether contracts have or have not been made with French purchasers. In the former event, if the export merchants are in a position to ship, a request for a licence should be immediately made to the Board; in the latter event, a demand should be lodged for the resumption of the general granting of export licences.

Price of Coal under the Limitation Act.

Difficulties continue to arise regarding the fixing of prices under the Price of Coal (Limitation) Act, owing to diverse interpretations. In consequence, the Board of Trade are being kept actively engaged in connection with disputes; and the Commercial Court of the King's Bench Division will in all probability have to adjudicate on certain technical points that have been raised. A short time ago we referred to the fact that the Luton Corporation, on behalf of their Electricity Department, were in controversy with the Ibstock Collieries over the subject. The proposal was, in this instance, to charge the Corporation upon the average price for the twelve months ending June 30, 1914. But the Board of Trade has held that "the price with which comparison is to be made is not the average price over the period of twelve months referred to, but the price under an actual contract corresponding to that under which the deliveries are being made." Again, in our issue for March 7 (p. 517), allusion was made to two pronouncements that Sir Thomas Ratcliffe Ellis, in the name of the Gas Coal Federation, had secured from the Board. In certain respects, those interpretations, we believe, are to be the subject of strong protest. The sooner all these questions are settled beyond dispute the better, so that those entering into contracts may have definite principles upon which to proceed.

The Standard Addition.

There seems, indeed, little that is at present absolutely positive about coal prices, except that the standard addition to the ill-defined "corresponding price" is 4s. per ton. Even the 4s. is likely to be the Verdun against which the coalowners will, as soon as there is substantial excuse, begin a strong offensive. As references in the "JOURNAL" have previously shown, there have been rumours that coalowners were casting around for some ground upon which to appeal to the Board of Trade for an increase of the 4s. Of course, they are at liberty to appeal; but the Board of Trade know full well that the 4s. includes a respectable margin for contingencies. Only last week (p. 574), it was mentioned that the Coal Conciliation Board for England and North Wales were considering a demand on the part of the miners for a 5 per cent. advance in wages. Now the "Iron and Coal Trades Review" says: "It is anticipated that if the Conciliation Board come to the conclusion that the men are entitled to this advance, the coalowners will apply to the Board of Trade, under section 1 of the Limitation Act, for leave to charge more than the present statutory 4s. margin above the 'corresponding price' upon all inland sales." But is it likely that the 5 per cent. advance in wages will be granted if the Conciliation Board are not satisfied that the rise in the selling price of coal does not justify it? If the Board of Trade granted an additional 1s. upon the 4s., we suppose the miners would seek to get a share of it. It is a nice arrangement under which the owners, merchants, and miners all have a personal pecuniary interest in making the British public pay as much as possible for coal.

British Commercial Gas Association.

The report of the Executive Committee of the Association (of which we publish some permissible parts in other columns) is a healthy record of activity in the interests of the gas industry. The Association seem to be taking a hand in almost every matter that concerns the welfare of gas undertakings during war time. Perhaps it is as well that the Institution of Gas Engineers, the Association, and the Society of British Gas Industries have formed a sort of coalition, to deal with problems where authority has to be approached or its sanction secured. Unity is strength; and though the interests represented by the three organizations are many, they all converge to the one point of the common good. But we must confess that it strikes us as rather strange to see such matters as naphthalene, sulphate of ammonia, sulphuric acid, and coal receiving prominent mention in the report of the Executive of the Association. They are subjects that we should have looked for in a report issued by the Institution. But mention of them in this report from the Association (among such topics as finance, use of gas in munition factories, and labour) is due to participation in attempts to obtain improved conditions in respect of them, and to the fact that they all bear upon the question of the price of gas.

Present Lines of Operation.

Regarding the ordinary functions of the Association, we are glad to learn from the report that, the war notwithstanding, new subscribers are coming in, and that the subscribers generally are showing their faith in the utility of the work by sending in their contributions in a manner that is highly encouraging to the workers. As to publicity work this year, the Committee are paying close attention to factory and workshop lighting, in view of the issue of the report of the Committee on Factory and Workshop Lighting; and water-heating appliances are also to have prominence. The makers of the latter have given the Committee an assurance that they will be able to supply requirements, unless unforeseen contingencies disturb their operations. "Unforeseen contingencies" have unpleasant frequency in these times. The Industrial Fuel Committee which has been appointed should also do excellent work. The portions of the report published by us do not divulge all the work undertaken by the Association. A list of subjects upon which information has been sought from the Association by subscribing undertakings, has a variety and a range that are astonishing. That answers were available for all the inquiries is a testimony to the depth of the available resources. The Association have also been directing attention to ancient misconception as to the uses of gas that is to be found in works that are accepted as standard ones. They seek correction; but no correction which cannot be justified by demonstration. There is strength in this attitude. The activities of the organization, like a thriving tree, burst out into new branches here and there. It is all to the good of the industry.

Gas Supply of Sheffield.

In face of a curtailment of the public lighting, the quantity of gas sold by the Sheffield United Gaslight Company last year was 5¾ per cent. more than that disposed of in 1914; while within the last four weeks over 60 million cubic feet of gas have been consumed in excess of the corresponding weeks of last year. These are big figures—so big, in fact, that at the annual meeting of the Company, the Chairman was impelled to say it could be wished, owing to the difficulties in getting coal, that the inhabitants would practise more economy in gas consumption. The results are excellent evidence that Sheffield is satisfied with its gas supply, and will perhaps convince the Engineering Correspondent of the "Sheffield Daily Telegraph" that the Directors are pursuing a sound policy in placing the ordinary domestic consumers on one footing as to price, instead of introducing a graduated scale of charges—which the Engineering Correspondent has urged is necessary to prevent electricity from becoming "first favourite." One can agree that the times are changed without at the same time agreeing that "gas has no longer the monopoly it had for light and power." A statutory undertaking still has a monopoly of the sale of gas, which is the only monopoly it ever did have. But that perhaps is taking too narrow a view of the meaning to be attached to the Engineering Correspondent's remark; and this we have no wish to do, for he has dealt with the subject courteously, and has frankly recognized that the price of gas in Sheffield has always been low—thanks (in addition to favourable situation) to good management. This is the gist of our own contention—that the price of gas is low to all, and that therefore reasonable cause for complaint, or for a change in the system of charging, does not exist. Sheffield, as is admitted, owes much to its Gas Company, which is an outstanding example of that beneficial private enterprise of which there are so many instances to be found in the industry. In spite of the picture of the possible result of municipalization which the Engineering Correspondent proceeds to conjure up, we doubt, with all respect, whether any municipal councillors would prove more public spirited than the Directors of the Company have shown themselves to be.

Reported Travancore Thorium Development.

It is stated, on authority which we have hitherto found reliable in connection with the Indian monazite sand question, that the Travancore Minerals Company are contemplating erecting a factory for the production in this country of thorium nitrate. If this is true, it has, it appears to us, an important bearing on the conditions laid down by the India Office as to the future working of the Company. In fact, the proposal looks very much like a means of protecting the profits of those who hold the major part of the capital, and, owing to the preferential conditions under which the Company would be working, of jeopardizing the commercial manufacture of nitrate of thorium by all other British makers, who, relying upon the terms imposed upon the Company by the India Office, may put down the necessary plant and purchase Travancore sands for the purpose. It will be remembered (or, if not, memory can be refreshed by consulting our issue for Aug. 10 last) that, after the agitation, largely through our columns, over the feeding of a Company in Berlin with the monazite sands from Southern India, while there was no sand available here for producing thorium nitrate, it was discovered that a large proportion of the capital of the Minerals Company was held, through the General Electric Company, by the German Company. The terms imposed for the future working of the Travancore Company were intended, among other things, to break-down the German control. Another condition was that the Travancore Company should give a formal undertaking that they would be ready at all times to sell monazite sand direct and at a fair price to *bonâ fide* British firms, without giving preference to large buyers. It comes to this that, if the report is correct as to the Travancore Company commencing the manufacture of thorium nitrate in this country, their position in relation to the monazite sands is such that, although they are bound to supply other British thorium nitrate makers, they would be able to effectually cut them out of the market, and so preserve the profits to the ultimate benefit of the German Company. At any rate this seems to us to be the position; and it certainly appears as though, in this way, the intentions of the India Office in making the conditions they did would be frustrated, and in the sweet by-and-by the Berlin Company would, through the proposed development, reap profit from the sale here of the thorium nitrate. It is well the British gas industry should understand what would be the effect of this reported prospective move. Such a move, it seems clear, was not foreseen by the India Office.

Science and Industry in Australia.

A Commonwealth Institute of Science and Industry (under the control of directors possessing the highest business and scientific attainments, acting with the advice and co-operation of a council), representing science and the primary and secondary industries of Australia, has been recommended by a Committee in a report which has been approved generally by the Cabinet. The report is, as a matter of fact, the outcome of the labours of a Committee appointed, as the result of a representative conference convened by the Prime Minister of the Commonwealth, for the express purpose of formulating a scheme for the application of science to industry. Feeling, as the result of their investigations no doubt that the fruits of scientific research into industrial problems would amply repay considerable expenditure, the Committee decided on an Institute, assigning to it the following, among other, functions: To consider and initiate scientific researches in connection with, or for the promotion of, primary or secondary industries in the Commonwealth; the collection of industrial scientific information and the formation of a bureau for its dissemination among those engaged in industry; and the establishment of national laboratories. Being desirous that immediate action should be taken, the Committee put forward suggestions, which the Cabinet have accepted; and in accordance with these, an Advisory Council will be appointed particularly to carry out, until the Institute is established, the first two of the three objects just mentioned. Educational and other public bodies, and private enterprises, will, too, be invited to suggest directions in which investigation would be of immediate practical use to producers and manufacturers. The proposal is one which will be carefully watched outside the Commonwealth. The new organization will not have an idle time, for the list of problems already suggested as urgent is quite formidable.

Last November it may be remembered an advertisement appeared in the pages of the "JOURNAL" in regard to the appointment of an Assistant Engineer for the Australian Gaslight Company. We have just learned, through the London Agents, Messrs. William Coward and Co., Limited, that a cable received from Sydney intimates that, after much consideration, the Board of the Company have decided to appoint a local candidate.

PERSONAL.

Having been selected to fill a vacancy, Mr. JACQUES ABADY'S services will again, as a member of the Westminster City Council, be devoted to the interests of the ratepayers.

OBITUARY.

The death has occurred, at a Leeds nursing home, of Mr. THOS. WORMALD, for a long period of years Engineer and Secretary to the Rothwell Gas Company. He was 69 years of age.

The death occurred, from apoplexy, on the 15th inst., at Finchley, of Mr. WILLIAM GALBRAITH, who was for many years Manager of the Ardrossan Corporation Gas-Works. Deceased was in his 81st year; and it was in 1910 that Mr. J. D. Keillor was appointed to succeed him at Ardrossan. For some years previous to that, Mr. Galbraith had had associated with him in the managership Mr. J. Mitchell, who was ultimately appointed Assistant Manager at the Dundee Gas-Works—leaving Mr. Galbraith again sole Manager.

SULPHATE OF AMMONIA FOR FRANCE.

A Question as to the Issue of Export Licences.

THE following letter regarding the above subject has been circulated by Mr. D. Milne Watson, the Chairman of the Sulphate of Ammonia Association:

> It has come to our knowledge that a few manufacturers who are over-burdened with stocks of sulphate of ammonia have received a letter from the Board of Agriculture leading them to hope that licences for France will be granted.
>
> This is manifestly unfair to those manufacturers who also have heavy stocks, but have not received the letter. In view of this, we wish to point out that the bulk of the business for France has already been contracted for by the usual export merchants and by the few manufacturers who have direct connections in France. Many of these contracts were made at much lower prices than the present, so that the action of the Board of Agriculture will mean great hardship to French buyers who have cheap contracts.
>
> Quite apart from this, only very limited tonnage is now available for France from one or two ports in the United Kingdom; and the Board's letter, in a large number of cases, will therefore merely serve to raise false hopes, as the sulphate could not be shipped even were a licence granted.
>
> Under the circumstances, we would advise you to confer immediately with the export merchants to whom you may have sold, as to whether they are in a position to ship to France, and, if so, to communicate with the Board of Agriculture requesting that a licence be granted. If you have not sold, it would be better to demand that the general granting of licences should be resumed, because the quantity required by France is only limited, and the season already very far advanced in that country.

Export Prohibitions.—A Supplement to the "London Gazette," dated Thursday last, stated that on and after March 27 the exportation of manufactured fuel would be prohibited to all destinations abroad other than British Possessions and Protectorates. The exportation of ramie stockings and ramie fabrics for the manufacture of gas mantles is also prohibited to all destinations abroad other than British Possessions and Protectorates.

Production of Petroleum in Trinidad.—The year ending March 31, 1915, was, according to a Colonial Office report, a satisfactory one for the companies engaged in winning petroleum in Trinidad and Tobago. The amount of oil produced during the twelve months was 14,230,871 Imperial gallons more than in 1913-14; the figures for the last three years having been as follows: 1912-13, 17,626,563 Imperial gallons; 1913-14, 22,523,060 gallons; and 1914-15, 36,753,931 gallons.

Midland Association of Gas Engineers and Managers.—Apart from the formal business to be transacted at the annual meeting on Thursday, and the address of the new President (Mr. C. H Webb), the agenda arranged by the Hon. Secretary (Mr. W. G. S. Cranmer) intimates that "notes will be contributed" by (1) Mr. John Bond, on "Benzol and Toluol Extraction by American Gas Oil;" (2) Mr. Hubert Pooley, on the "Extraction of Benzol and Toluol by Green Oil;" and (3) Mr. George Stevenson, on "Carbonization and Toluol Extraction."

Coke-Breeze for Boiler Heating.—Mr. H. W. Bowden, referring to the use of coke-breeze under the boilers at the South Metropolitan Electric Light and Power Company's station, mentioned at the Company's meeting recently that the results obtained over a period of nearly twelve months showed a considerable saving, notwithstanding some excessive repairs due to design and stressed conditions. Although, owing to the demands on the plant, the experiment had been abandoned, he saw no reason to prevent the exclusive burning of coke-breeze (unassisted by coal) in a boiler-house properly designed and ventilated. This, he said, was important when using forced draught with a sulphurous fuel.

ELECTRICITY SUPPLY MEMORANDA.

Electrical Alien Enemies.

The Institution of Gas Engineers has not given harbourage among its ordinary members to men who can now be described as alien enemies. There are among the honorary members two or three names of famous men who are German and Austrian subjects. But the reasons for which they were elected to honorary membership stand as good to-day as on the day of their election. The members of the Institution, therefore, have no cause to trouble their heads over the expulsion or retention of alien enemies. But the Institution of Electrical Engineers has found itself almost rent in two over the subject of expulsion—on the one side being ranked the moderates, and on the other side the extremists. The matter has been discussed at meetings of the members; and the proceedings were long and some of the views strong. The Council submitted a resolution providing an addition to the Articles of Association for the exclusion at any time from any class of membership of any person who is the subject of an enemy country. But when the proposal was under discussion, a section of the members seemed to think the rules should be altered so as to include beyond those members who are not naturalized in this country, those who are naturalized here, but are not denaturalized in the country of their birth. This is taking a stride over the bounds of necessity, and perhaps of what is legitimate. The "Electrician" understands that the law as to denaturalization was only introduced into Germany in 1913; and, under this circumstance, there would be men, whose native land is Germany, who have spent many years as naturalized British subjects, and have an honoured record, but who have not, after having been naturalized here so long, seen since 1913—even if they had had the opportunity of taking the required steps—any necessity for becoming denaturalized in Germany.

Legality and a Vote.

On this naturalization question we have always retained the view that at heart a Britisher could never be anything else than a Britisher; and, tested by the British standard, a German at heart could never be anything else than a German. Of course, honour comes in, and the oath of allegiance would be binding on some Germans, but we cannot say this for all. There are such things as "scraps of paper." However, when a man becomes legally naturalized, he can claim the right to legal treatment; and it is therefore very doubtful whether a man who has become naturalized in this country could be expelled from any technical Institution or Association. The matter might be somewhat different were the organization a purely commercial one, and the "naturalized" subject known to be merely the agent in this country for German goods or for developing German business interests. There would then be substantial reasons affecting the trading interests of this country for asking such a person to "make himself scarce." However, the Institution of Electrical Engineers, unable to arrive in meeting assembled at a unanimous conclusion, have decided to take a postal vote of the members on three aspects of the subject: (1) Expulsion of members who are subjects of enemy States: (2) expulsion of naturalized British subjects who have retained enemy nationality; (3) rendering ineligible for membership the subjects of enemy States after the war. If aspect No. 2 obtains a preponderance of votes, there will then be the legal tangle to deal with; but the fact that the point is being put to the vote shows how in the electrical industry—and it is the same in others—the inhuman methods of warfare adopted by Germany have created a deep-rooted and far-reaching desire to banish as far as possible from our midst all that is German, and all those who, born in Germany, have not already completely detached themselves from it.

Coke Fuel at Central Stations.

Several electricity supply stations are using coke or coke breeze for steam-raising in this difficult fuel-procuring time. This is largely due to the energetic work of the fuel expert of the London Coke Sales Committee (Mr. E. W. L. Nicol), and the balance of credit can be entered up to the difficulties of obtaining coal supplies. It is a good thing that this experience has come along, as, in the electrical industry, there formerly existed a good deal of scepticism and misconception regarding the use of coke. But this was due to want of experience; and that want is no longer present in some very substantial electricity supply stations. The South Metropolitan Electric Light and Power Company are among those who have had experience of mechanical firing with coke breeze. To the matter, Mr. H. W. Bowden, the Engineer-in-Chief, made allusion at the recent meeting of the shareholders. As an economic proposition, he had nothing but good to say regarding it. The trial has been running nearly twelve months; and the results show a "considerable saving," notwithstanding "the excessive repairs and attendance required." Mr. Bowden attributes these drawbacks, which, however, are compensated for in the final economy, partly to design, and partly to the stressed conditions under which working has been carried on, due to the late delivery of plant. But for the time, owing to the heavy demands on the station, the trial has had to be abandoned. However, he sees no reason why there should not be exclusive burning of coke breeze in a boiler-house designed for the purpose, and well ventilated. This, in his view, is important when using a forced draught, and more particularly so with sulphurous fuel. This last point is interesting, but not very clear, because the coke does not contain such a large percentage of sulphur as the original coal—the sulphur content of the coal being distributed through various carbonization products. Mr. Bowden is looking forward to continuing the trials, when there is an easing of the demand at present experienced upon the station plant.

Electric Cooking from a Private Generating Plant.

The Royal School for the Blind at Leatherhead requires a large steam-boiler plant in connection with its heating system. Having a steam-boiler plant, a development has been a private electricity generating plant; and, having this, and desirous of getting as good a load as possible for it, a further development has been an electric cooking installation. As the cooking is a day load, it is stated that there has been no material increase in the fuel consumption; and so it is claimed that there has been a clear saving of upwards of £80 per annum as a result of the change-over from gas to electricity. The pre-war rate for gas is, in the article on the subject in the "Electrical Times," placed at 3s. 8d. per 1000 cubic feet, which figure, it is believed, has since been increased. No details are offered as to the actual cost of the electric current consumed for cooking; perhaps it would be difficult to give them with a steam-generating plant always required for other purposes, and an electricity-generating plant gasping for more breath in the way of additional work. However, the equipment comprises a large cabinet-type roasting and baking oven, a treble-oven range with boiling-plates, a large grill, and an electric stock-pot. Loaded at full heat to 12 KW., the large oven accommodates upwards of 2 cwt. of meat at a time; the average weight cooked being about 130 lbs. Now all cooks know that the boiling operations in the preparation of food and for general kitchen purposes are at least three times greater than those in which baking and roasting are concerned; and so it is not surprising to learn that the electrical method has not been adopted for boiling. There are three steam-heated boiling-pans, and a large hot cupboard is heated by the same agency. Regarding the consumption of the electric-cookers, it is mentioned that these had been in daily service since June of last year; and during the 227 days up to Jan. 31 last, the current consumption totalled 6853 units, giving a daily average of 30·18 units. The average number of persons cooked for daily, including staff and inmates, is no fewer than 250; so that the consumption is only 0·12 unit per person per day. This is, of course, accounted for by the fact that no great variety of dishes is prepared every day, although large quantities of food are called for to meet the needs. The "Electrical Times," in its article, does an injustice to the cooks of the establishment, simply owing to its ardour in the cause of electrical operation. Speaking of the oven, it says: "A sliding drawer in the base collects the fat, which, instead of being black and burned, *as it would be with a gas-oven*, is perfectly white and pure, and is made use of in the kitchen." Why "would be with a gas-oven?" Fat is not blackened or burned in households with which we are acquainted; and why should the cooks at the Leatherhead Royal School for the Blind be behind other cooks in their manipulation of a gas-oven. Then, again, it is stated that "the cooks find there is a substantial saving in the weight of meat with electric cooking." We know of cooks who have failed to find this difference. Why should they, given cooking at equal temperatures?

Wounded Soldiers and High Explosives.

These are days when, in the cause of economy and war financing, we are asked to be frugal, to eschew the little luxuries that we were wont to indulge in in peace times, to give up unnecessary pleasures—including theatres, music halls, motor car trips, and dining at hotels and restaurants when home is handy—and to wear our old clothes, even though our trousers have become baggy at the knees and our coat sleeves a bit rubbed and otherwise showing signs of hard wear. We are trying to follow the prescription in spirit and to the letter—out of loyalty to our country. Probably there are many of the residents at Worthing who endeavour to do the same. We trust and expect they are; and while they are shunning all forms of extravagance themselves, it is to be hoped they will not encourage the—more so to-day than ever—unpardonable vice in others. The inhabitants of Worthing have been asked to subscribe £58 10s. to the banishing of gas from, and the fitting-up of electric light at, a place called "The Grange"—is now a convalescent home for wounded soldiers. Mr. Sidney O. Stephenson, the Engineer and General Manager of the Worthing Gas Company, entered a protest in local papers against this unnecessary expenditure, when money is badly required for other more important matters, and when, to win the war, the source of the supply of high explosives must not be in any way depreciated, but must be enlarged to the utmost extent. Above all places in which nothing should be done to lessen the source of supply is a home for wounded soldiers—probably many of them wounded through the large provision of high explosives that the Germans had made prior to the war, and are still making from the gas and tar resulting from the carbonization of coal. The Germans are urging their people to burn less coal and more gas and coke. The persons who want to banish gas from "The Grange" at Worthing, and put in electric light, are working to the contrary end—they are playing into the hands of the enemy; they are, in short, contributing to the production of a shortage of the very substances with which the Germans are so well supplied. They may plead that their proposal only means a very small difference. If all those who control small differences argued the same, what then? At the beginning of the war, this country, to its everlasting disgrace, had only a few tons of toluol in hand; but the nation's thanks are due to the gas undertakings for the energetic manner in which they came to the rescue to save the British Armies and Navy, and the country from a defeat that would have been humiliating and disastrous to the nation, and would have placed practically the whole world at the mercy of the most despotic of Powers. Ignorance goes a long way in shaping actions. Whatever is the result of the newspaper warfare at Worthing, Mr. Stephenson has had no difficulty at all in presenting a case full of cogent, telling argument. But he is not an intolerant ultra-prejudiced controversialist. "The selection of an artificial illuminant," he writes, "is a matter for each individual's choice. But this is not an ordinary time." True, and the country's interests, (not personal inclinations, fads, and fancies) must—at any rate, for the time being—come first.

The Electric Furnace. An article in "Electrical Engineering" tells the reader that the electric-furnace is making progress in the Sheffield steel trade; but the extent of the progress is not numerically attested. The progress, we gather, is not due to the war so much as to the intrinsic merits of the electric furnace. Steel manufacture depends for its success on the complete elimination of all impurities from the raw material fed into the furnace; and it is claimed that the electric process permits the refining and purifying of the material to operate "to a much higher degree than is possible in the older furnace." The note of praise continues: "It is in rendering the difference between excellence and super-excellence possible . . . as a regular process repeatable at will that electricity has taken the manufacture of high-class steel one stage further." Then, again, the demand for superlative qualities of steel has been so well met by the electrical method that to-day it holds an assured position in the industry. In view of the success of the gas-furnace in the metal industries—gas-furnaces dealing with tons per charge as well as pounds and ounces—we cannot find heart to begrudge the electric furnace an amount of useful application. But the claims strike us as being rather too general, and not sufficiently specific. The information is given that the Héroult type of furnace is much in evidence in Sheffield; the one manufactured by Electro-Metals, Limited, is also in favour; while there is "one" sample of the Rennerfelt furnace in use. We cannot describe the furnaces in detail. But it may be said they are all of the arc type, but differ in the manner of applying the arc. The Héroult furnace consists of three electrodes each carrying one phase; the current passes through the electrodes, to and along the surface of the metal in the furnace. In the type introduced by Electro-Metals, Limited, a two-phase connection of the three-wire type is used. The "A" and "B" phases are attached to vertical electrodes, which are lowered into contact with the charge in the furnace. The common return lead is connected to the bottom point of the furnace beneath the basic lining. This bottom electrode consists of a layer of a mixture composed of tar, dolomite, or magnesite. The lining is burnt in, and when hot is said to be a good conductor. The object of the design is to obtain the benefits of a bottom heat on to the charge. The Rennerfelt furnace strikes the arc above the charge, and then deflects it upon the surface of the metal. This furnace is worked by two-phase current, and three electrodes. All three types work with low-pressure current; control being obtained by varying the arc between the electrodes; while for the different purposes of the initial heating and the refining stages, control is available by alteration of the voltage at the transformers. It is claimed that the electric furnace removes every trace of sulphur out of the steel, and thereby raises its quality; and so, in the end passages of the article, we arrive at the conclusion that the trend of events "seems" to indicate a very important future for the electric steel furnace.

Murdoch Lodge.

The installation meeting of the Murdoch Lodge was held last Thursday at the Imperial Hotel, Temple Street, Birmingham, when W.Bro. Sidney O. Stephenson installed his successor in the chair, W.Bro. Captain S. P. Thornton, P.M. 2702. The following officers were subsequently invested:

Senior Warden	Bro. Harold Eveson
Junior Warden	,, W. J. Rendell Baker
Chaplain	W.Bro. Luke B. Taylor
Treasurer	,, Fred Vale
Secretary	Bro. Frank Jervis
Charity Steward	W.Bro. Vincent Hughes
Senior Deacon	Bro. H. J. Woodfine
Junior Deacon	,, C. H. Webb
Director of Ceremonies	W.Bro. T. E. Vale
Assistant Director of Ceremonies .	,, W. A. Sapey
Organist	Bro. H. V. Stanton
Assistant Secretary	,, Lieut. Robert Scott
Inner Guard	,, W. M. Valon
Senior Steward	,, Forrester Clayton
Junior Steward	,, Major W. R. Glover

FUEL ECONOMISTS.

By W. J. A. Butterfield, F.I.C., Assoc.Inst.C.E.

[Continued from p. 578.]

The Large Gas-Engine for Power Stations.

The alternatives to present practice fall into two groups, both of which involve preliminary gasification of the raw coal. The first group covers the gasification of the coal and the consumption of the resultant gas in internal combustion engines. At the present time, the engineering advisers of large power undertakings are unable to recommend the adoption of internal combustion engines for power station work. Greater reliability and greater efficiency of large gas-engines are necessary; and as experimental work and research in this direction are extremely costly, it is a question whether a Committee constituted by makers of gas-engines and large power producers should not be formed to undertake the development of large units of the internal combustion engine. Whether the power producers alone should provide the funds, or whether in a matter of such national importance the Committee would not have a reasonable and independent claim on the Government for a substantial grant in aid of the work, is debatable. If, however, any funds, whether derived from the suggested tax on exported coal or otherwise, are provided by the Government for furthering the cause of economy of fuel, there is no question that a considerable proportion of those funds should be ear-marked for the development of the large gas-engine.

Unfortunately investigation and development of the gas-engine have of late been neglected, owing to the more insistent claims of users of petrol and heavy-oil engines; but it should be remembered that the available supplies of coal, even in Great Britain alone, will suffice to produce gas of a potential value for power production far in excess of that of the whole world's known oil-resources. The development of the large gas-engine is work in which the chemist should take a leading part; but the modern tendency of those responsible for the education of chemists in our universities and colleges to despise the worth of a comprehensive training in inorganic chemistry and physics, leaves us with few chemists of the present generation competent to collaborate to any purpose with the mechanical engineer in industrial work of this kind. The engineer, left to his own devices, is by nature an empiric (in the best sense of the word) while the organic chemist in ninety-nine cases out of a hundred busies himself with the minor problems to deal with which alone he has been properly equipped. The major problems of chemical industry—such as the combustion to the best advantage of gas in the internal combustion engine—are consequently solved very tardily. Yet in the solution of this and kindred problems, there is better prospect of effective economy of fuel than in the greatest triumphs of the organic chemist in the synthesis of colours and drugs from the constituents of tar, though it is on tar that the theorist in fuel economy generally harps.

Gaseous Fuel for Boiler Firing.

Pending the improvement of the large gas-engine, we are left with the second alternative to the consumption of raw coal for the generation of steam. This alternative consists in the gasification of the coal and the employment of the products of gasification for generating steam. There are three ways in which this alternative may be varied, viz.:

(1) Complete gasification, in one operation of bituminous coal, to form a fuel gas, such as is yielded by Mond, Duff, or Kerpely producers, and the use of the gas as boiler fuel.

(2) Carbonization of the coal, and the direct employment of the resultant coke as boiler fuel, with or without the use of the resultant coal gas also as boiler fuel.

(3) Carbonization of the coal, gasification in a producer of the resultant coke, and the employment of the producer gas, with or without admixture with the coal gas, as boiler fuel.

The first and last of these variations involve the use of gas as a boiler fuel, and the second may do the same partially. It is therefore useful to inquire how the evaporative duty of gaseous fuel compares with that of coal or other solid fuel. Apart from the pioneer work of Professor Bone, who is no mere theorist in fuel economy, there is comparatively little definite information available as to the efficiency attainable in the firing of large boiler units by gas. The most definite published statement relating to fairly large units in every-day working, of which the writer is aware, is by Mr. H. A. Humphrey, who stated, in the paper on "The Generation and Distribution of Producer Gas in South Staffordshire" which he read before the Institution of Civil Engineers in 1912, that a test of gas firing of the Lancashire boilers at Dudley Port, lasting 40 hours, showed a "heat-efficiency, as between calorific value of gas and heat in steam generated, of 79·1 per cent." This figure, of course, compares favourably with the efficiency obtainable from coal, and is especially valuable, because it was obtained from a type of boiler in general use with only a comparatively small and simple addition to adapt it for the use of gaseous fuel. It is appreciably lower than figures obtained by Professor Bone and others in special trials or smaller scale working with specially equipped boilers;

and there is no doubt from these figures that an every-day efficiency of as much as 90 per cent. from gaseous fuel is not altogether beyond expectation in the future. But it is certain also that the maximum efficiency in the firing of boilers with raw coal has not yet been attained. Paying due regard to the advances which will inevitably be made in the firing of boilers with both types of fuel, and to the differences between the results of efficiency trials and every-day working, it may be anticipated that the heat efficiency, as between calorific value of the fuel and heat in steam generated, will never be much more than 15 per cent. higher for gas than for raw coal, when both are used by the best available method as fuel for large boilers. The difference will often be appreciably less; but it should always be in favour of gas.

Bituminous-Coal Producer Gas.

The simplest method of gasifying coal for the production of a power gas for firing boilers is by means of the Mond or other suitable producer, with or without recovery of the ammonia from the gas before consumption. It is not, however, a method which will appeal to Professor Armstrong and most theorists on fuel economy, because such tar as is produced is not rich in benzene or the other hydrocarbons on which they set a sentimental value out of all proportion to their commercial value in normal times. A large part of the nitrogen in the coal may, however, be recovered in the form of ammonia—in fact, in some cases the gas becomes a bye-product, of which a large proportion is completely wasted; the producers being worked primarily for the manufacture of ammonia from bituminous slack. Whether (to quote Professor Armstrong) this is "provident utilization of the abundance" of combined nitrogen in coal, as compared with the consumption of coal at Ludwigshafen for the direct production of ammonia from atmospheric nitrogen is a question of practical significance which may be commended to the attention of theoretical fuel economists. There seems no reason, however, why, in suitable local conditions, the same coal should not be utilized in both directions, and a double return of ammonia obtained from it. One locality occurs to the writer where such a procedure should have an assured success, even if the general market value of sulphate of ammonia fell to the lowest figure hitherto experienced.

In cases, however, where the producer is primarily required for gas production, and its working is controlled according to the demand for gas for firing the boilers in a large power station, the ammonia is a bye-product which may or may not be worth the outlay for its recovery. The paper by Mr. H. A. Humphrey, already referred to, gave figures on the working month in and month out, of the Mond producer plant at Dudley Port, from which some interesting deductions can be drawn. It appears that the average yield of sulphate of ammonia from coal containing 1·16 to 1·19 per cent. of nitrogen was 81 lbs. per ton; of tar from coal containing 35·3 to 36 per cent. of volatile matter 190 lbs., or (say) 17 gallons, per ton; while the calorific value of the gas made represented about 64·5 per cent. of the calorific value of the coal gasified. The gas manufactured includes that used for firing the boilers and other purposes on the works; and the calorific value of the gas sold by the South Staffordshire Mond Gas Company appears to have represented only about 48·7 per cent. of the calorific value of the coal gasified. If the approximate calorific value of the tar is added to that of the gas sold, the percentage in the gas and tar of the calorific value of the coal gasified is about 59·5 per cent. Since, however, power was in this case used for distributing the gas, and for cleaning it more thoroughly than would be necessary if it were merely required for boiler firing on the spot, it is not right to take so low a figure as representing the probable thermal efficiency of Mond producer plant if installed in connection with a large power station. But this figure does gives some indication of the proportion of the calorific value of the coal which would be "wasted"—to use the word of the theorists—if coal were gasified by this method at the pit-head and the gas distributed thence to industrial users. For boiler firing, even allowing for a greater evaporative efficiency from the gaseous fuel, such distributed gas could hardly compete with raw coal used directly in a modern boiler plant.

The gas made at Dudley Port, however, represented less than 65 per cent. of the calorific value of the coal gasified, without deduction for the gas consumed in the work's boilers. If to this figure there is added the calorific value of the tar produced, we get approximately 75 per cent. of the calorific value of the coal gasified recovered in the gas and tar. It thus appears that the actual loss in heat units entailed in the gasification of coal by this method is about 25 per cent. Looking at the matter in another way, the consumption of 25 per cent. of the calorific value of the coal may be regarded as the coal equivalent of the recovery of 81 lbs. of sulphate of ammonia from a ton of coal. The figure of 75 per cent. for the thermal efficiency of the Mond producers at Dudley Port is very near that obtained in an efficiency trial in 1911 of Kerpely producers consuming coke breeze at the Corporation Gas-Works at Vienna. These producers require no separate boiler installation; and the proportion of the calorific value of the coke which was recovered in the gas available for use—viz., 75·37 per cent.—is therefore clear of any deduction for gas or other fuel used for steam production for the service of the producers. In the Dudley Port installation of Mond producers, the 75 per cent. efficiency is subject to a deduction, which cannot be exactly estimated from the figures published by Mr. Humphrey, under this head.

From the foregoing figures, it may be inferred that it is possible to gasify bituminous coal in Mond or Kerpely producers with a loss of about 25 per cent. of its calorific value. This means that if the gas and tar are used as boiler fuel with an evaporative efficiency of 85 per cent., less than 65 per cent. of the calorific value of the coal is actually utilized in the generation of steam. This is certainly no better than the evaporative efficiency of raw coal; and the only asset of the gasification process is about 70 lbs. of sulphate of ammonia per ton of coal for every 1 per cent. of nitrogen in the coal. This yield of sulphate of ammonia has to pay for the cost of the sulphuric acid contained in it, for the labour and other working expenses of the producers, ammonia recovery, and sulphate plant, and the interest and depreciation charges on the whole of the plant. Even with cheap sulphuric acid and a good market price for sulphate of ammonia, it will be fairly evident to gas engineers that the ammonia recovery will not pay these expenses and charges. It would appear, therefore, that a very much higher efficiency than 75 per cent. must be obtained from this type of producer if it is to compete in equal conditions with raw coal as a fuel for large boiler installations. There are, of course, cases in which, with a producer of this type, a poor grade fuel, which would not serve very well for the direct-firing of boilers, may be utilized; but these are outside the general question, raised by the theorists, of the abolition of the use of raw coal.

(To be continued.)

WASTE OF COAL AND COAL PRODUCTS.

DEFENCE OF THE OPEN DOMESTIC FIRE-PLACE.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

A not unusual failing on the part of a full-fledged University Professor of Science, qualified to string half the letters of the alphabet, after his name, is a rather senseless contempt for established methods and procedure and for the practical man who can claim nothing beyond a full stop. Yet the fact remains that, although the professor has done much towards the advancement of applied science, the practical man has done more. The spread of education has had the effect of bringing the two classes more intimately into contact, led to the cultivation of a mutual respect, and to a realization of the fact that each has its proper place under the sun, and is in a sense complementary to the other. But the old-fashioned academical prejudice has not yet died out; and in no instance is this more evident—not even as regards the gas industry or the gas engineer—than in that of the open fire-grate, so dear to the heart of every Englishman, which has been unsparingly condemned, both by the scientific voice and the scientific pen, for the last half century. But it is yet going strong to a sufficient extent to warrant consideration (in view of the fact that it cannot be ended) of the extent to which its ways might be mended.

The domestic fire-grate, as it exists to-day, is a great (no pun intended) advance on the deep, open-bottomed structure that was a feature of the early Victorian era. This gave way in favour of the "register" type, fitted with a flap-door for the purpose of regulating the chimney draught, which, in its turn, was replaced by the slow-combustion pattern, closed-in below the fire-bars, as now generally fixed in all modern buildings. In connection with discussions on the subject, I have not observed any recognition of this improvement. But it cannot fail to exercise an important effect. Many speakers or writers seem to have overlooked it, and to have in view the old-fashioned and now practically obsolete Victorian grate. In this respect they resemble the electricians, who exhibit an extraordinary preference for a delapidated old flat-flame burner, when collecting data as to the illuminating value of gas, rather than a modern appliance that will do proper justice to the subject.

These considerations may possibly appear more suitable to the columns of a journal devoted to the interests of domestic or national economy, than to those specially concerned with the manufacture and distribution of town gas; but the gas industry occupies the remarkable position of a competitor and also of a supporter of the open fire. A necessary sequence to its primary operation is the production of a large quantity of solid smokeless fuel that is available for use to an important extent, in conjunction with coal, in the open grate; and the gas-fire has now been improved to such a degree that it can advantageously displace the coal-fire in certain circumstances. These matters are therefore well within the horizon of practicable gas politics.

No existing method or procedure can retain a prominent position in the public estimation in the absence of advantages or attractions of sufficient importance to commend it to the general use. The comforts afforded by the open domestic fire are far more widely appreciated, if seldom mentioned in speech or print, than the defects that are so stentoriously proclaimed from the lecture platform, or by means of scientific literature. It is sufficient to remark that the former have been successfully reproduced in modern gas-fires. Some defects attributable to the open form of grate—such as the escape and worse than loss of certain valuable substances by way of the chimney, are inherent to the principle of construction, and as such cannot be cured; but the production of smoke and soot, and the excessive consumption of fuel, commonly spoken of as being unavoidable, are largely and unnecessarily exaggerated by the firmly established habit of negligent and incompetent usage.

Pending the introduction of the drastic, not to say next door to impossible, remedies that would appear to be all that the professors of science can suggest (and which are very much on a par with the actions of the Government in restricting the applications of coal tar at a time when the existing distilling plant throughout the country was not equal to the utilization of the large surplus thus thrown on the market—the natural result being an artificial slump in price and difficulties in securing clearance at that—of bringing about similar circumstances in regard to coke and sulphate of ammonia in the absence of evidence that the home demand would absorb the whole production, and in recommending nitre cake as a partial substitute for oil of vitriol in the sulphate of ammonia house) it may be worth while to divide the defects generally laid at the door of the open fire-grate into two classes—those that are incurable, and those that can be remedied to a greater or less extent by the intelligent application of such simple means as are feasible to, and within the reach of, every householder. One sometimes hears that a certain personage, at one time considered unmentionable in polite society, is "not so black as he is painted," and it is an easy matter to show that the open fire is called upon to answer, not only for its own sins, but also for those of the individuals who are supposed to look after it. Gas engineers have frequently found that the cheapness, ready adaptability, and long-suffering disposition of gas is an actual drawback to its use, as leading to a degree of recklessness and wastefulness that would not be possible, or would not be tolerated, in the case of a more expensive or less elastic medium. The same thing holds good with the open fire-grate.

The principal trouble of this class is brought about by the widely-established prejudice to the effect that a fuel in small pieces is of necessity inferior to the same material in large lumps, if not unscrupulously used as a means of adulterating the same. As a consequence, coal (and in a more limited degree gas coke) is for the most part supplied to the purchaser in blocks much too large for efficient use; and any action in the way of breaking to a fairly even and suitable size is more honoured in the breach than in the observance. In a general way, by far the greater part of the "breaking" is done in the fireplace, and after the fuel has been partly consumed; and the unnecessarily frequent and violent use of the implement known as a "poker" is an established institution. The poker was never intended for, and is not suitable for use as, a coal-breaking tool; its application to this purpose is an abuse and not a use. The proper place for the breaking process is the coal cellar, and not the fireplace. Anyone who can invent a cheap, simple, and effective machine for breaking coal into fairly even-sized pieces, about 1½-inch or 2-inch cube, and secure its general use—the latter condition being perhaps more difficult of accomplishment than the former—will do more towards the advancement of coal economy and smoke abatement than has been accomplished by all the talk of the last ten years. Gas companies as a rule supply broken coke for household use; but, in view of the prejudice against "smalls," which applies equally to coke, they are unable to carry the breakage to the extent that is best suited to the capacities of the drawing-room or dining-room fire. Anyone who has tried small coke, such as that which has passed a 1½-inch mesh, but over a ½-inch (and, as a consequence, only realizes about two-thirds the price of large, though quite equal in quality), in conjunction with coal, on an ordinary slow combustion open stove, will agree with this assertion.

Ordinary gas coke is subject to special defects, apart from the matter of size, that tell heavily against its use as a household fuel. It is water-quenched in the first place, and exposed to the weather, sometimes for a long period, in the second, and is usually delivered to the consumer in a soaked condition, so far as the exterior surface of the pieces is concerned. The actual percentage is not large enough to constitute an important consideration in connection with the selling price, as, unless purposely drenched, soaked in standing water, or recently exposed to unusually heavy rain, the water does not penetrate to any extent below the surface. It is more like a sheath on the outside. But, such as it is, the whole must be evaporated before ignition will commence. This objection is especially evident if it is used in admixture with coal, or put on the fire at the same time. The heat rendered latent by the drying process corresponds to that absorbed in the case of coal for the gasification of the volatile matter. We have observed that the fireplace is not the proper place for breaking fuel, and it certainly is not a suitable locality for drying it.

Coke must of necessity contain 40 or 50 per cent. more incombustible ash than the coal from which it was made; and if this coal was an inferior article, containing 10 per cent. or more of incombustible matter, all of which is passed on to the coke, one cannot expect to do an extensive household trade. The objection does not obtain with the average run of gas coke, properly applied, because the economy of fuel is sufficient to counterbalance the increase of ash—indeed, the average twelve-hour production may be less than when coal is used exclusively under customary conditions. Given a dry quenched and dry stored coke, in 1½-inch cubes, we should hear much less about the difficulty of using coke on the parlour fire, or of the need for a special brand of low temperature, and more readily igniting, material. It is evident that many who talk about the need for a fuel of this description, and the conditions incidental to the manufacture and supply of it, have had no practical experience in connection therewith. They have forgotten that the first half century of the gas industry—previous to the introduction of the fire-clay retort—afforded practical opportunity for a long practical trial of soft low-temperature coke; but no one seems to have recognized or appreciated its value. The writer was at one time associated with a gas-works where a low-temperature carbonizing process was in use for two or three years, and a coke of the quality attributed to "Coalite" was placed in the yard for sale side by side with ordinary gas coke. So far from realizing a higher price, customers were continually stating that they did not want any of "that soft patent stuff," and asking for the hard coke in preference. The soft coke depreciated by storing, even if stacked only 6 feet high, in the course of a few weeks, and quantities of it had to be disposed of in the works' boiler fire for this reason. In practice, the soft coke would almost need to be wrapped in cotton wool.

The managers of gas-works, who are far and away the largest consumers of gas coke, might with advantage give more attention to the proportion of ash in coal in their own interests, apart from those of the consumer or the outside trade—and this not only in connection with retort-house furnaces, but also in regard to its influence on carbonization and the production of gas.

All who are interested in the reduction of the smoke nuisance and fuel economy would do well to disregard air bubble schemes involving the aid of special legislation, or plans for next to impossible changes in established habits and customs, for a time, in favour of a few simple experiments that can be easily carried out in their own homes. Much of the benefit that has been already accomplished by the reduction of smoke from factory chimneys is the result of more careful usage of existing plants rather than its displacement in favour of some new scheme for combustion, such as charging the fuel in even layers or small quantities by some mechanical means. When bituminous fuel is used, the smoke from a fresh charge is caused to pass over a previous charge that has reached a more advanced stage of combustion.

One cannot expect to carry these improvements to so great an extent in the domestic fireplace; but this does not warrant the conclusion that there is no room for an advance on the usual practice of dumping-on half a scuttleful of coal or so two or three times a day, in pieces of all shapes and sizes, and of jabbing at the mass with the poker whenever so inclined, without regard to the need for such action so far as the process of combustion is concerned. At the present price of coal, apart from the national question, an economy worth consideration in these hard times can be secured by conducting the stoking of the fire, not necessarily on more scientific principles, but on plain common-sense lines. What would be thought of a furnace man who threw on coal in chunks of a size sufficient to nearly cover the whole area of the furnace bars, and in quantity equal to filling the entire fire space? But one often sees coal thrown on to the dining-room or drawing-room fire in lumps as big as one's head, or heaped halfway up the chimney, and the same broken up before they are warmed through; the result being volumes of black smoke for several minutes before the appearance of flame. Or lumps of all sorts and sizes thrown on higgledy-piggledy, leading to irregular combustion and short-circuiting of the draught; the current following the lines of least resistance. There is vivid incandescence in one part, and black unignited, but smouldering, coal in another part of the body of the fire.

If, in place of this procedure, a supply of coal is provided more evenly broken, and in pieces commensurate with the horizontal area of the grate on which they are to be used, also of gas coke similarly treated, and stoked with even and not too thick layers at more frequent intervals, exercising the same degree of care and periodical attention that is applied to other household duties, the poker will only be required for its legitimate purpose of clearing accumulations of ash at the lower part of the fire; and a marked improvement in the volume of visible smoke, the quantity of fuel used, and the even warming of the apartment, will result. The gas coke may be mixed with the coal or used alternately, according to circumstances; and it will be possible to secure a considerable part of the advantages that are, of course, readily obtainable by the use of soft low-temperature coke.

Natural Gas Supply in Hungary.—The Hungarian Upper House having discussed and passed the necessary Bill, the Hungarian Natural Gas Company has been formed by six Hungarian banks and the Hungarian Incandescent Gaslight Company on the one side and the German Bank and the German Petroleum Company on the other side. The Board of Management is to consist of 22 members, the Chairman of which is to be nominated by the Minister of Finance. The capital is to be 20 million kronen (about £833,000), of which 4 million kronen is to be allotted in payment for the cession of the natural gas fields, and the balance is to be subscribed in equal parts by the Hungarian and the German groups interested in the scheme.

THE EVOLUTION OF THE MODERN CHARGING AND DISCHARGING MACHINE.

By H. C. Widlake, M.J.Inst.C.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

[*Concluded from p.* 581.]

Electrical Compensating Gear.

In the same manner as in the older type of single-motor machine a mechanical method of compensation had to be provided whereby power could be transmitted between the outer and inner frames of the machine at any vertical position of the latter, so in all types of machines have electrical compensating means to be employed in order to ensure continuous communication between the electrical apparatus—motors, controllers, and resistances—situated respectively on the inner and outer frames of the machine, irrespective of the vertical adjustment of the hanging frame. These conditions have been met by the employment of suspended flexible cables, guide-pulleys, and weighted pulley blocks to take up the slack. But in the later machines these arrangements are superseded by the use of vertical "banjo" wires strained up the sides of the outer frame, to or from which the electrical apparatus situated on the inner frame gives or collects its current in exactly the same way as the machine itself collects its motive power from the overhead trolley lines—namely, by the use of sliding or roller contacts pressing against these banjo wires. This arrangement combines the dual characteristics of neatness, simplicity, and reliability; while it provides a ready means of isolating the various circuits of the machine for testing in the event of a fault occurring. Small refinements of this nature cost but little extra, while they contribute largely to the maintenance of the machine in a thoroughly efficient condition.

Source of Electricity Supply.

While the purchase of electrical energy in bulk from an outside source offers a very convenient alternative to the installation of private generating plant, it must be remembered that it is scarcely desirable that so important a unit of the gas manufacturing plant should depend for its continuous operation upon an extraneous source of power, which experience proves cannot be considered as reliable as regards immunity from failure. The best insurance against the possibility of a dislocation of the even tenour of retort-house operations by the failure of the electrical supply is the installation of a private gas-driven generating plant in duplicate. A compromise between this and the purchase of power from an outside source is the use of a single generating set, supplemented by an emergency service from the supply authorities' cables. This compromise, however, is an expensive one, as electrical supply people do not look with much favour on such emergency supplies, and base their charges per annum for the accommodation upon the maximum kilowatts which, by the terms of their agreement, they have to hold themselves in readiness to supply at any moment. This annual charge has to be met, even though the emergency supply is never resorted to; any units used being charged for additional to the fixed annual charge.

A generating set working upon the load provided by an electrically operated retort charging and discharging machine is bound to be operating under a very poor load factor, and no effort should be spared to improve this load factor by extending the electric drive to other units of the plant to which it can be economically applied. As soon as the flexibility and convenience of the electrical system of power transmission and application become realized, new uses will be found for the plant; and by applying electric driving to (say) three or four coal and coke elevators or conveyors whose period of operation coincides with the use of the stoking machine, a good load factor will be provided for the generating set which will enable it to work at or near its maximum efficiency.

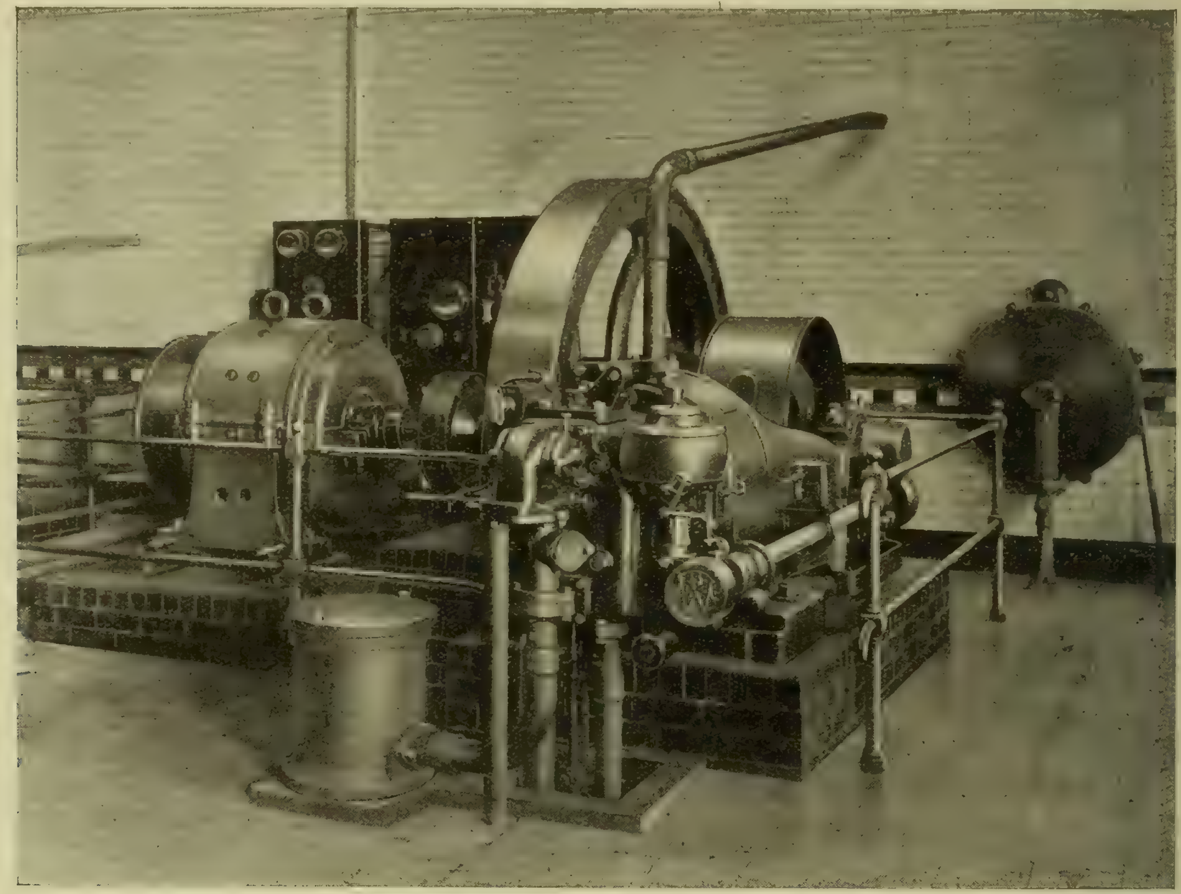


FIG. 8.—WESTINGHOUSE 52 B.H.P. GAS-ENGINE AND DIRECT-COUPLED GENERATOR AT THE SOUTHPORT GAS-WORKS.

Before deciding upon the capacity of the set or sets he proposes to instal, the prospective user of electrical power in connection with a stoking-machine will be well advised to look around and make a fairly close estimate of the extent to which he can economically employ the new plant. The makers of electrically operated stoking machines and telphers are always ready to quote for the complete installation; but their interests, naturally enough, do not extend beyond the plant they are supplying. Therefore the engineer who is installing such a plant should see that the generating set is rated, not upon the basis of the demand provided by the stoking machine or telpher as the case may be, but upon the basis of those purposes to which, after a survey of his existing methods of driving, he may decide he can advantageously apply electrical operation. He will thus save himself the annoyance of finding himself saddled with a plant the rating of which renders it impossible for him to take full advantage of a system which his own progressive ideas have introduced into his works.

The capacity of generating plants on comparatively small undertakings ranges from 20 to 50 kilowatts; and a typical example of such an installation is shown in fig. 8, which depicts a direct-coupled 52 B.H.P. generating set, manufactured by the British Westinghouse Company, installed at the Southport Gas-Works. The writer has no information concerning the load under which this particular installation operates; but for the purposes of illustrating the approximate cost of generating electricity by means of such a set, let it be assumed that the load is such as to maintain a 75 per cent. load factor on the engine, and, further, that the efficiency of the dynamo at this load is 90 per cent. The output of the engine at this load-factor will be $\frac{52 \times 75}{100} = 39$ B.H.P., or 29,094 watts; while the actual power available after conversion to electrical energy will be $\frac{29{,}094 \times 90}{100} = 26{,}184$ watts, or (say) 26 B.oT.U. per hour. At a 75 per cent. load factor the engine will take 10,640 B.Th.U. per B.H.P. hour, or 19 cubic feet of 560 B.Th.U. gas; and the consumption will therefore be $39 \times 19 = 741$ cubic feet per hour, or $\frac{741}{26} =$ (say) 29 cubic feet of gas per unit of electrity.

The following table shows the cost of power generation with this set per B.H.P. hour and per kilowatt hour (B.oT.U.) at varying prices of gas:

Rate per 1000 *Cubic Feet of Gas.*

	1·0	1·2	1·4	1·6	1·8	1·10	2·0
	d.	d.	d.	d.	d.	d.	d.
Cost per brake horse power hour . .	0·228	0·266	0·304	0·342	0·380	0·418	0·456
Cost per kilowatt hour	0·348	0·406	0·464	0·522	0·580	0·638	0·696

This table is based on the varying costs for gas alone, and does not take into account the extra costs imposed by interest, depreciation, and lubrication charges, which in the case under consideration, and assuming a working period of 2800 hours per year at three-quarter engine load, would amount to about 0·15d. per B.H.P., or 0·22d. per unit generated.

CONSUMPTION OF CURRENT.

Although electrical operation of power-using machines provides a unique method of obtaining the most accurate records of the relationship existing between a given accomplished amount of work and the energy expended in the performance of the same, it is a regrettable fact that the average gas-works power plant is absolutely devoid of the simple appliances by which the data can be obtained. The result is that it is difficult to get hold of any really reliable data in this respect, while many engineers who employ electrically operated stoking machinery have not the remotest idea of the amount of coal or coke they can handle by the expenditure of a given amount of electricity.

Let us take the case of any of the various makes of stoking machines engaged upon the work of discharging the caked coke from retorts. Assuming equal conditions as regards the section and general condition of the retorts, amount and class of charge, it is obvious the same mechanical effort will have to be applied to discharge its contents in a given time, and any difference which may exist in the various machines in regard to the amount of electrical energy consumed in the operation of this task will depend upon the relative efficiency of their gearing. The installation at the Coxside works of the Plymouth and Stonehouse Gas-light and Coke Company with which the author is associated is served by two Fiddes-Aldridge simultaneous type machines—one a single-motor machine and the later one having a separate travelling motor in accordance with latest practice.

The following figures give the results of a test taken for the purpose of this publication with a view to determining the relationship between the bulk of material handled, the electricity consumed, and the time factors of the different motions. No mention is made of the raising-lowering motion, as in this installation this motion is used to such a small extent as to render its effect on the working costs negligible. The conditions were absolutely normal; no effort being made to speed-up the operations. The test was taken haphazard on a typical charging-discharging round of 35 minutes. The performance shown is not by any means out of the common. As a fact, the time per retort could have been improved upon had the operator been instructed to get over the ground as quickly as possible.

It will be observed that in the data immediately preceding the table the consumption of electrical energy is stated to have been 4 B.oT.U., or 0·097 unit for each retort charged and discharged; whereas in the table itself this figure is given as 3·362 units, or 0·082 unit per retort. The discrepancy is due to the fact that the first reading was taken by an integrating watt meter, and may therefore be regarded as correct; while the consumption shown in the table was estimated on the basis of observed average amperes, the time, and the average pressure. While the latter figures could have been adjusted to the watt hours, as shown on the watt meter, which was known to be correct, the author considers that such a procedure would rob the record of much of its value, as it is obvious that only by a very strange coincidence could the estimated wattage in a circuit where all the factors were constantly varying be calculated so closely as to check accurately against a watt meter record. The times of the different operations were taken by a stop-watch, while the average current was estimated by a series of visual observations on a test ammeter; and considering the varying nature of all the factors, it will be seen that the figures in the table, brought to a wattage basis and compared with the recorded kilowatts, are in themselves an excellent testimony to the care with which the test was carried out.

A further result of observation and experiment has shown that when the Fiddes-Aldridge machine is used for discharging alone the energy consumed per retort is about 0·075 B.oT.U., as against 0·097 B.oT.U. when the simultaneous operation is performed.

Type of machine	Simultaneous.
Number of motors	Two—Stoking and raising combined and travelling separate.
Number of retorts charged . .	41 16-inch by 22-inch by 20 feet, through.
Distance travelled by machine between first and last retort .	About 240 feet.
Time taken (total)	35 minutes.
Time taken (per retort) . . .	51 seconds.
Electricity consumed (total) . .	4 B.oT.U.
Electricity consumed (per retort)	0·097 B.oT.U.
Total coal carbonized	8 tons 6 cwt.
Average charge	8·1 cwt.

Table Showing Particulars of Operations.

Operation.	Time.			Electrical Energy Consumed B oT.U.		Average Observed Current.
	Per Retort.	Total.		Per Retort.	Total.	
	Seconds.	Min.	Sec.			Amperes.
Discharging and charging simultaneously . . .	16	10	56	0·039	1·599	40
Withdrawing chain from retort . .	12	8	12	0·026	1·066	35
Travelling . . .	8	5	28	0·017	0·697	35
Total . . .	36	24	36	0·082	3·362	—

These figures are confirmed by an earlier test taken by the writer on the same machine and under the same conditions in September, 1914. In this case the test extended over a period of two weeks, during which time 2075 tons of coal were handled and 5188 charges of 8 cwt. (average) were placed in, and discharged from, a corresponding number of retorts. The wattmeter for recording the consumption of electrical energy was calibrated by its makers before the test, the results of which are as follows:

Duration of test	14 days.
Coal carbonized	2075 tons.
Number of retorts charged	5188
Average weight of charge	8 cwt.
Electricity consumed (total)	482 B.oT.U.
Electricity consumed (per retort)	0·093 ,,
Electricity consumed (per ton of coal carbonized) . .	0·23 ,,
Tons of coal handled per B.T.U.	4·35 tons.

CONCLUSIONS.

In view of the assistance afforded him by the makers of the different machines dealt with in this publication, the author much regrets that the only tests he has by him are those referring to the machines on the plant of which he happens to be in charge. Data of this sort are, unfortunately, difficult to obtain; and it is suggested that gas engineers who use electricity for the various operations in their works would be doing a great service by inserting wattmeters in their circuits and equating the amount of electrical energy consumed over a given time with the amount of coal and coke handled. The use of such instruments should not be regarded as a luxury but rather as an absolute necessity to the engineer who desires to get all he can out of his plant. By such means alone can he keep his finger on the pulse of the various units and detect incipient defects not only in the motor but even to a greater extent in machines to which the motor is coupled.

Whether it be stoking machinery, elevators, conveyors, or telphers, it will be found that a certain ratio exists between the amount of current consumed over a given time and the amount of material handled in that time; and so long as the machine remains in good condition, the ratio will keep the same. When wear or misalignment takes place in (say) an elevator or conveyor, the ratio will alter; and the observant engineer will see that it requires more electricity to handle a ton of coal, and will at once look for the cause. In short, these instruments afford an invaluable check upon the mechanical condition of every machine driven by an electric motor, and the cost of installation will be soon wiped out by the lower maintenance charges in respect to such machines. Any diminution in the efficiency of a machine so driven can be at once detected, and the "stitch in time" applied before the trouble shows itself by an actual stoppage.

While the use of electrical plant on gas undertakings is steadily increasing, engineers as a whole are slow to avail themselves of the facilities which the electrical drive affords for the easy and accurate measurement of power, and are too prone to look upon the integrating wattmeter and the recording ammeter as expensive luxuries. A striking example of the extent to which a well-known Continental gas engineer takes advantage of such characteristics was afforded in an article on the South Gas-Works, Amsterdam, by Mr. J. Van Rossum du Chattel, the Chief Engineer of these works, which appeared in the "JOURNAL" for Jan. 5, 1915. Mr. Rossum du Chattel showed that no less than 69 motors, aggregating 716·6 H.P., were employed for a wide range of purposes on his works, while the current for all the operations was metered; the consumption for one year being given as 565,624 K.V.A. hours (the supply is an alternating one).

In placing this article before the readers of the "JOURNAL," the author desires to express his thanks to the British Thomson Houston Company, of Rugby, for permission to use the particulars published of the crane motor supplied by that firm for the operation of stoking machinery. He also desires to make it clear that he holds no brief for any particular type of machine, and has dealt with machines made by firms whose names are household words in the gas industry.

In conclusion, he desires to express his thanks to Mr. P. S. Hoyte, the Chief Engineer of the Plymouth and Stonehouse Gaslight and Coke Company, whose courteous permission has enabled him to publish particulars and tests concerning the stoking installation at the Coxside works of the Company.

BRITISH COMMERCIAL GAS ASSOCIATION.

Report of the Executive.

A Meeting of the General Committee of the British Commercial Gas Association was held last Tuesday week, when the Executive submitted a report of which the following are some items.

Publicity Campaign for 1916.

The steady inflow of subscriptions has enabled the Executive to proceed with all arrangements for the spring and summer publicity campaigns. They have taken advantage of the publication of the report of the Home Office Committee on Factory and Workshop Lighting to call attention in the Technical and General Press to the fact that all the recommendations of the report can be easily fulfilled by the employment of modern incandescent gas lighting.

The campaign will also deal with water-heating appliances and cookers. The makers have reported that they will, unless unforeseen contingencies arise, be in a position to meet a normal demand for water-heaters.

The Gas Industry and War Conditions.

The Executive have endeavoured to be as vigilant and active as possible in guarding the industry from avoidable injury arising out of war conditions, while always regarding the interests of the nation as a whole as absolutely paramount. The following are the points upon which action has been most necessary and has been taken in conjunction with the Institution of Gas Engineers and the Society of British Gas Industries.

(1) In regard to the questions of the greater possible usage of gas and of financial facilities, a deputation representing the three bodies at the end of October had an interview with Sir Sothern Holland and other officials of the High Explosives Branch of the Ministry of Munitions. This resulted in a strong letter being addressed by the Minister of Munitions to all Government Departments, emphasizing the national importance of gas being used wherever possible; and in our being asked to furnish the Ministry with particulars of all specific cases of threatened displacement (or ignoring) of gas, or of financial stringency hindering the development of gas manufacture.

The Secretary obtained particulars of numerous cases under both headings, and had frequent interviews with officials of the Ministry, with the result that steps were taken by them, not without success, to press upon other departments the claims of the industry to consideration, and to induce the financial authorities to modify their attitude on the question of additional capital required. The Secretary also had interviews with officials of the Board of Trade and the Local Government Board on the same subjects. Letters from the Association to the Secretary of State for War, the First Lord of the Admiralty, the Postmaster-General, and the Commissioners of Works, putting the case for gas before them on behalf of subscribing undertakings, brought sympathetic replies, and it is believed have had considerable effect.

The Chairman also, on behalf of the Association, had an interview with the Director of Factory Construction, with the result that a memorandum explaining why gas should be used, and how it could be used, in munitions factories was sent out by the Director to every such factory in the country. The Director also took prompt action in cases subsequently brought to his notice by the Association of proposals to ignore gas where it could be employed with marked advantage. Correspondence between the managers of factories and the Director, and reports received from gas managers, have shown that the action taken had good effect.

Everything possible has been done to bring to the knowledge of the public the fact that, by the continued and increased use of gas, consumers were assisting in the production of munitions of war.

(2) In regard to the naphthalene difficulty, it was decided, after careful consideration, that, as this was a local trouble, experienced in some districts and not in others, it would be better for it to be dealt with locally. A circular putting the facts before consumers was therefore prepared for the use of members; and large quantities were ordered and distributed in the affected districts.

(3) In regard to the labour difficulty, steps have recently been taken to impress upon the authorities what the result would be upon the output of explosives, and upon the labour problem in the home and in industry, if the maintenance of existing, and the supply of additional, gas appliances were seriously restricted by the wholesale withdrawal of labour from the outdoor departments of the gas industry and the stove-makers' works. The Explosives Department have promised to make strong representations on the subject to the Labour Priority Committee, and, if necessary, to arrange for evidence to be heard by that Committee.

(4) On the question of sulphate of ammonia, the Executive, in support of, and after consultation with, the Sulphate of Ammonia Association, have addressed a letter to the Board of Agriculture, protesting against the prohibition, or an undue limitation, of the export of sulphate.

On the question of sulphuric acid, their information is that the Ministry of Munitions and the Board of Agriculture are doing all they possibly can to assure adequate supplies, but that the military requirements are so enormous, and still increasing, that the production cannot keep pace with the demand. The Sulphate of Ammonia Association hope shortly to issue a memorandum on the subject of the suggestion made by the Ministry of Munitions, that gas-works should use nitre cake in small quantities as a substitute for sulphuric acid. The question will be kept under close observation; and if any useful purpose can be served by action in support of the Sulphate of Ammonia Association, it will immediately be taken.

(5) In regard to coal prices, the Executive are prepared to take action in support of the existing Coal Committee immediately there is any definite ground for believing that any proposal to sanction a further advance in coal prices is under serious consideration by the Government.

Assistance Rendered.

In addition to the assistance rendered to the industry as a whole outlined in the foregoing, the Association continues constantly to afford assistance to the members and their undertakings individually.

Another branch of the service to the industry which is being rendered without any outward sign of its operation, but is of particular and far-reaching value, is that concerned with the correction of what is wrong in, and the supply of what is missing from, the information respecting gas in text-books, handbooks, and works of reference, both popular and scientific.

Industrial Fuel Committee.

The following members have been constituted a Standing Committee on Industrial Fuel: Messrs. Broadberry, Clarry, Goodenough, George Helps, Hilton, Roxburgh, Thornton, Walter, R. Watson, and Yates. The extract given below from the minutes of the Committee will explain what work is in hand. It will be readily understood that nothing more than preliminary work can be done under the present abnormal conditions.

> It was resolved that information respecting typical installations of industrial fuel appliances be collected, and carefully classified according to the various sections and trades, so that a general index might be prepared which could be published and distributed for the use of members. The opinion was expressed that such a record would undoubtedly prove of material advantage in subsequently developing the more general adoption of gaseous fuel for industrial and business purposes.
>
> It was felt, however, that until the war was over no very strenuous action in this matter could be undertaken; but the Secretary was instructed to proceed with the preparation of a complete list of all trades, and the collection of available information—the members promising hearty co-operation and assistance.

COAL TAR AND HIGH EXPLOSIVES.

The first of two lectures on "Explosives and Drugs Made from Coal Tar Products," by Professor H. E. Armstrong, F.R.S., was delivered at the Royal Institution last Thursday afternoon, when, in addition to hearing many facts of peculiar relevancy at the present time, the audience witnessed a great number of practical demonstrations.

Beginning with the days of saltpetre and charcoal, progress was traced through the making of gun cotton from cotton, nitric acid, and sulphuric acid, down to the most modern high explosives, derived from coal tar—that is, from carbolic acid and toluene. The manufacture of gun cotton and nitroglycerine was practically illustrated, as well as the making of the later explosives. In the case of toluene, the lecturer explained, it is necessary to convert the substance into trinitrotoluene—an operation which involves three stages. First of all, it is converted into the mono-nitro compound; then into dinitrotoluene; and finally into trinitrotoluene, by the action of a concentrated mixture of nitric and sulphuric acid. In the second stage, instead of a liquid substance there is a solid one produced; and a sample of this was melted down to show the third stage. A considerable amount of heat is produced in the first stage; in the second stage, very little; while in the third, it is necessary to add some heat in order to bring about the change. The resultant product is, of course, much more powerful than nitro glycerine or gun cotton. It is extraordinarily sharp and quick in action, and very local.

In the course of his lecture, Professor Armstrong brought forward convincing evidence to show the close connection that has all along existed between the Royal Institution and explosives; this really forming part of the history of the subject. Nitroglycerine was invented in 1847, but not experimented with on a large scale until about 1860, when Nobel took it up, and it began to come into use as a blasting agent. Later on Nobel introduced blasting gelatine. Then came cordite (sticks of which were shown, and fired by the lecturer, with no other result than a flare). Attention was drawn to the important work that has been performed by Sir Frederick Abel and other prominent investigators in connection with the subject.

The Massillon (Ohio) Electric and Gas Company have always experienced some trouble from water and quicksand whenever an excavation is made at their plant side. The latest trouble was encountered when the Company's workmen began to excavate for the foundations and condenser pit of a new 6000-kilovolt-ampère turbo-generator. In order to remove the water, a sump in the excavation was connected by a 4-inch pipe line with the Le Blanc condenser of a 2000-kilowatt machine already operating in the station. The condenser took its cooling water from the pit through this pipe instead of from a canal. As the pit was excavated the pipe line was lowered by adjusting a double-L connection placed in the line for the purpose. This scheme, besides providing an inexpensive means of lifting the water, possessed a further advantage in that it provided the condenser with cold circulating water.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS & MANAGERS.

The Annual Meeting of the Association was held last Thursday, at the Hotel Cecil, Strand, W.C. There was a large attendance of members. At the commencement of the proceedings, the Retiring President (Mr. J. W. Auchterlonie, of Cambridge) was in the chair.

Minutes Confirmed.

The President pointed out that the minutes were taken as printed in the "Journal of Gas Lighting;" and he would ask the members to confirm them.

Mr. Samuel Glover (St. Helens) moved the confirmation of the minutes.

Mr. B. R. Green having seconded the motion, it was unanimously carried.

Report and Accounts—Institution Benevolent Fund.

The report in the main was a review of the proceedings of the year. From its concluding passages, it is gathered that during the year twelve new members have been elected, and five have resigned. As to the accounts, the total amount of the subscriptions received in respect of the year was £98 14s.; and the total expenditure was £96 6s. 6d. This expenditure was somewhat larger than usual, as the cost of the tea at the March meeting and the expenses of the special meeting at Caxton Hall were borne by the Association. There has also been considerable correspondence in connection with the education of gas-fitters.

The President said he had pleasure in proposing the adoption of the report. It would be noticed that the income of the year had only been slightly greater than the expenditure—some £2 or £3. The reason possibly for the higher expenditure was the amount of printing matter and postage that had been necessitated, especially in connection with the gas-fitting classes. This matter, of course, was in working order now; and the expenditure might reasonably be expected to be less in future. They had also had one more meeting than was the case normally. Meetings, naturally, cost something; and incidentally they meant, with some 200 members, much extra work for the Hon. Secretary. There was one other matter he should put before the members. The Benevolent Fund of the Institution of Gas Engineers was deficient to the extent, he believed, of from £30 to £40. He appealed to the members in greater number to support the fund. A good work was being done by it; and he agreed with the suggestion that had been made that sample instances of the work—not giving names, but designating the cases by "A," "B," "C," &c.—should be circulated, to show to members of the industry something as to the character of what was being done through the fund. In connection with the deficiency, the Committee recommended that a grant of 10 guineas should be made. The Manchester Institution and the North of England Association had each voted 10 guineas to help the fund; and he thought it was up to the Southern Association to subscribe an equal sum to help to meet the deficit.

Mr. J. Donaldson (Tonbridge) seconded the motion for the adoption of the report; and it was unanimously carried.

Proposed by Mr. D. T. Livesey (East Grinstead), seconded by Mr. A. Caddick (Croydon), a sum of 10 guineas was voted to the Benevolent Fund of the Institution.

Election of New Members.

The Hon. Secretary (Mr. H. C. Head, of Winchester) read, in the following order, the nominations for membership: Mr. John A. Gray, of Teignmouth; Mr. W. H. Hammond, of Eastbourne; Mr. Thomas Curr, Bankside Gas-Works of the South Metropolitan Gas Company; Mr. Charles G. Dawson, of Paignton; Mr. Edwin Dunbar, of Southampton; Mr. R. G. Luxon, of Launceston; Mr. F. A. West, of Sittingbourne; Mr. W. Thomson, of Ramsgate; and Mr. C. H. Rutter, of Brighton.

Moved by Mr. A. Caddick, and seconded by Mr. S. Glover, these gentlemen were unanimously elected to membership.

The Retiring and New Presidents.

The President remarked that this completed the duties of his year of office, except one, and that was to induct his successor. Mr. Doig Gibb was known to every gas engineer in the Southern District, and he ventured to say to all throughout the United Kingdom. It would be idle therefore for him (Mr. Auchterlonie) to dwell on the many virtues and abilities of Mr. Doig Gibb. He had already received the highest honour that the gas profession had in its power to confer—that was, the presidency of the Institution of Gas Engineers. They all knew how well he then fulfilled the duties of the office; and he (Mr. Auchterlonie) thought he was only voicing the opinion of the members of the Association when he said that they took it as an honour to have Mr. Doig Gibb as their President. He wished him a successful year of office, and that he might see the war terminated, and the country back to as near as possible normal times, before he handed over the office to his successor.

Mr. W. Doig Gibb then took the chair, and was heartily greeted by the members.

The President said his first duty, on taking the chair, was to move that a cordial vote of thanks should be given to his predecessor, Mr. Auchterlonie. The members knew that, in spite of the strenuous year they had passed through, Mr. Auchterlonie had been untiring in his efforts to keep the Association moving in the best possible path; and that, at considerable inconvenience to himself, he had maintained the highest traditions of the office in a style worthy of anyone who had ever before occupied the post. Although he (the President) unfortunately was prevented from being there, he understood the members had an exceedingly pleasant and profitable day on their excursion visit to Cambridge. From this visit they knew that Mr. Auchterlonie not only shone in the presidential chair, but in the administration of a gas undertaking as well. He (the President) was sure that the members would be quite unanimous in according him their heartiest thanks for the way he had presided over the destinies of the Association during the year just closed.

Mr. Samuel Glover, in seconding, said the able way in which Mr. Auchterlonie had conducted the business of the Association, and had presided over them, had endeared him more deeply than ever before, if this were possible, in all their hearts. Cambridge had been (so to speak) an ever-open door to pilgrims who wanted to see a model gas-works managed in a model way. He was pleased to see that Mr. Auchterlonie was looking no worse for his strenuous year. He had again proved, as all of the younger members might prove some day or other, that the occupying of the presidential office had the effect of making an engineer a better engineer, and a man a better man. They knew Mr. Auchterlonie better through him having been their President; and they desired to express their hearty thanks for his services.

Mr. Auchterlonie said he thanked Mr. Doig Gibb and Mr. Glover for their too flattering remarks. To him his year of office had been a great pleasure; and the Hon. Secretary and his colleagues on the Committee had made the work extremely easy.

Representative on the Institution Council.

Mr. W. N. Westlake (Exeter) moved, and Mr. B. R. Green (Mitcham) seconded, that the President be the representative of the Association on the Council of the Institution during the ensuing year.

The motion having been adopted,

The President, in his acknowledgment, said he need not say more than confess that this was very genial employment. He liked to be on the Council of the Institution, because by being there he got to learn more as to what was going on.

PRESIDENT'S ADDRESS.

Gentlemen,—I have thanked you once already for the honour which you have conferred upon me by electing me President of your Association; but I thank you again now—both because my feelings prompt me to do so, and because otherwise the preface to the remarks I am about to make would be incomplete.

I would that it could have been my happy lot, on taking the presidential chair, to be able to congratulate you on the termination of this terrible war. Alas, the end is not yet; and we have no alternative but to fight on until our aspirations, and our firm intentions, have become accomplished facts. We can all fight, and I hope that we are all fighting, in some way or another, for our country, and for all that makes life to us worth living—for freedom, for justice, for humanity, indeed for civilization itself. That we are fighting for all these things, Germany has herself incontestably proved by the line of conduct—or rather, misconduct—pursued by her in the portions of Belgium and France that have been overrun by her armies. Just for one moment contrast the brutalities (of which there is ample proof) perpetrated by the Germans upon women, children, and unarmed men in the sorely-tried countries that I have named, with the long, expensive, disinterested, and successful efforts put forth by Great Britain to abolish the slave traffic, with all its horrors. Never has Germany, or any one of the German States that preceded the birth of the present monster, done anything except to gain her own material ends; never moved, except to further her own selfish aims.

In saying we can all fight, I am, of course, using the word in its broadest sense. In our own case, we can strike a very effective blow for the country by exerting ourselves to the utmost to produce the necessary chemicals for explosives, in munition work, and sparing every possible man who is able and willing to join the Colours. With quiet determination, we must keep things going, and see the matter through. We must keep calm and cheerful, and, in short, "make the best of a bad job." We shall be strengthened in the determination which we all feel to be unceasing in our efforts to help on the good cause, if we bear always in mind that the "bad job" was not of our making, and that the complete success of the Allies against a strong and ruthless foe will secure a happy future for our descendants, if not for ourselves.

When I came to think over what I should talk about in my address—always a difficult matter for a president to decide, and a problem which tends to become even harder to solve as time goes on—I found myself faced at the very outset with a difficulty. Occupying the position of a "free lance," through not being connected with any particular gas undertaking in the ordinary way, it is possible for me to avoid giving you a description of special plant erected, or work that has been done. But the result of this is to still further restrict the field that is open to me to touch upon—a field already much limited through the exhaustive and able manner in which the past twelve months' history of gas business has been dealt with by the "Journal of Gas Lighting" in its review of the year 1915.

The present position and happenings, to a large extent, dominate the thoughts of us all; and there is little which I can usefully say in addition to what has been published. But I would like to pay a well-deserved compliment to our Technical Press; for, well served as we always have been, the present crisis seems to have found our editors and their staffs anxious and willing to do their "bit." When I have asked relatives, who are temporarily residing in different parts of Europe, how the war is getting on, I get the same answer: "They are doing their bit; and if everyone else does the same, we shall win through." The future, as regards the war itself, must not for a moment be allowed to be in doubt; but as for the many other things in the future, who can tell? I have selected a few of the problems, present and future; and some general remarks on these will not come amiss.

TOLUOL AND BENZOL.

In view of my statement as to the importance of exerting ourselves to the utmost to produce the necessary chemicals for the manufacture of explosives, you will no doubt be expecting me to say something about benzol and toluol. It will be known to all of you that, when the war started, the urgent call was for "toluol." Later on, the situation changed, and the call was for "toluol and benzol;" and now the call is for "benzol and toluol." At the commencement of the war, the immediate greater production of toluol was of vast importance. It was known to be in the gas; but new plant and securing suitable oils or chemicals from outside sources would have meant serious delay. There is no doubt the very valuable suggestion of Mr. Charles Carpenter, which has enabled the industry to almost immediately increase the output of toluol in such a simple manner, has been of the greatest possible utility to the country. His process required practically no new plant, and employed, as a washing medium, a product of the gas-works themselves. The process was generally adopted; and the great majority of the gas-works throughout the country are working it with more or less successful results—the results varying, not because of the process itself, but with the different sizes and designs of the plants which it was found possible to allot to this particular purpose.

With the approach of summer, any possible scheme having for its object the keeping-down of the temperatures of the gas and tar should be at once put in hand. In many works, the tar supply could be cooled by leading the supply-pipe through any existing cold-water storage tank. In one works, an excellent result has been obtained by putting the supply-pipe down into, and up from, a sunk well. At Bournemouth, as one small part of Mr. Moon's cleverly designed and ingenious oil-washing plant, the hot-oil pipe has been led through the pump flow from a well.

If the tar used be too thick, or if a little more can be afforded from the gas, a small addition of oil to the washing tar will help the working and increase the desired contents in the finished tar. The great point about tar washing is to use the tar as free as it is possible to get it from water, to employ it in comparatively large quantities, to keep the gas and the tar at a temperature not exceeding 60° Fahr., and, above all, to secure as intimate a contact between them as may be allowable, when back-pressure and other considerations are taken into account.

BENZOL AND TOLUOL.

The situation has, however, now undergone a change; and the growth in the demand for benzol is such as to render it highly desirable that administrators of gas-works should consider whether they cannot go beyond the stage of tar washing and wash with oil, in order to get better results, especially in benzol. The suggestion I am making is, of course, not a new one to some of you; but the matter should be considered by all those whose operations are on a sufficient scale to justify them entertaining the idea. There are already many instances throughout the country where engineers, on their own initiative, have constructed more or less makeshift oil plants from old material at their disposal; and there is eloquent testimony to the ingenuity and determination of these gentlemen in the fact that a number of these home-made plants are working satisfactorily and giving excellent results.

A Presidential Address at the present time is not a suitable medium for conveying much detailed information about either tar or oil washing; but the necessary information can easily be acquired by those who wish for it, either by application to the Superintending Engineer of your district (Mr. H. O. Carr) or to any of his assistants, or to the Department of Explosives Supplies, with which I am temporarily connected.

TAR DEHYDRATING PLANTS.

The installation of tar dehydrating plants is being recommended for many works as, once erected, these plants will always be useful, even after a return to normal times. If not employed in handling tar, they can be used for the debenzolizing of treated oil. Though a cheap substitute, in small works, for a proper steam-heated oil-distilling plant—especially if this latter would have to be ordered complete from an outside plant manufacturer—they are not so efficient, if thorough oil washing is carried out, and present some elements of danger in being direct-fired. But we are at war, and much useful service can be rendered by their intelligent use.

NAPHTHALENE TROUBLES.

A discussion on tar and oil-washing naturally introduces some remarks on naphthalene troubles. With the severe fall in temperature that was experienced last November, some of the undertakings which were carrying on efficient tar washing were troubled with a great increase in the number of naphthalene stoppages. Curiously enough, however, this unpleasant experience was only felt in certain areas; other parts seeming not to be affected at all, though the temperatures were to a great extent similar. Cumulative evidence goes to show that these troubles were probably due to the tar-washed gas (of lower vapour tension) picking-up naphthalene which was already in the mains, and depositing it again in the smaller, and presumably cooler, service-pipes. Speaking generally, the direct effect of the tar and oil washing processes is to decrease the naphthalene contents in the finished gas, and not to increase them.

Of suggested remedies for the trouble, there are no end. Leaving out vertical retorts (which are an expensive remedy, if only for the purpose under discussion) and working at lower heats (which would help towards the greater production of benzol and toluol, if not of "gas made per ton"), these may be classed as carburettors or sprays.

The lighter spirits cannot be at present used; and the carburettors are therefore generally worked by steam heat acting on paraffin oil (such as is used in lamps), over which the whole volume of the gas, or part of it, is passed. The use of 15 to 20 gallons of this oil per million cubic feet of gas seems to be sufficient in nearly all cases, if it be used in time, and its use continued. There is no need for anyone to wait for the present uncertain delivery of suitable plant, for the construction is of the simplest, and the working is efficient as long as the oil is taken up and not deposited in the syphons. I have come across several home-made plants, heated by gas-jets or steam, which are doing their work quite well.

Sprays are also being used for the purpose. The great point is to have a spray which will atomize the oil, and force it into the gas in a very fine mist. The mist is formed by three methods—blowing in by air pressure, blowing in by gas pressure, and blowing in by oil pressure.

I cannot agree that blowing in by air pressure is desirable. The introduction of air into the gas is a retrograde step. No doubt, the quantity is very small, and is probably more than made up (in most ways) by the oil introduced at the same time. But its use is unnecessary, when a small gas compressor will allow gas to be used as the atomizing medium. If air pressure be available, and it is not convenient or economical to specially compress gas for the purpose, it is easy to cap both ends of a suitable sized straight length of pipe, put this on end, use it as an oil reservoir with air pressure on the top, and atomize the oil by itself through a suitable nozzle. A very short time, once in (say) 24 hours, suffices to turn the air pressure off and fill up the reservoir with oil.

By any of the three methods, the gas will permanently take up a considerable quantity of oil, and no deposition will be found in the syphons. If precaution against over-running be required, an oil lead back from a syphon at no great distance from the nozzle is easily arranged. It has been found that the oil either settles out very quickly or (practically) not at all. The great point seems to be to blow the oil mist along a straight line of pipe of as large diameter as possible, and not allow it to impinge on any surface more or less at right angles to its initiatory line of travel.

Above all—and this not only applies to naphthalene troubles indirectly due to tar and oil washing, but generally—do not come too hastily to conclusions. I have in mind my own experience in days before this war was thought possible. It was the usual start—increasing complaints and "something had to be done." A carburettor was put up, and got to work. More, and still more, complaints came in; and it might have been said then that the whole thing was a failure. But close touch with the question (in days when workmen were more easily obtained) revealed the fact that, month after month, the leading main was being completely cleared of all traces of naphthalene at greater and still greater distances from the works. What was taking place was evident. The gas was picking-up naphthalene, and carrying it forward for a certain distance, and then depositing it where it was a greater nuisance than ever. Perseverance was the only way to "make good;" and, after doing so, it was comparatively simple to keep there—varying the strength of the remedy according to the changing conditions.

THE TAR QUESTION.

The differences of opinion between tar distillers and gas undertakings are not a product of the war, though this has undoubtedly accentuated them. The present position includes the claim of the gas undertakings that their tar is now of greater value, and that no adequate extra allowance (in many cases) is made for this, and also that such removals of tar as will relieve them from congestion are not carried out. On the other hand, the tar distillers are hampered with large stocks of pitch and creosote oil, and are not in a position to do as they might have done in pre-war times. But, with all the statements and facts known to everyone, there is a general feeling that the gas undertakings are not being treated with the fairness which might be expected, when consideration is given to what they are doing for the country, and that the question between the two parties is essentially a national one. I know that there are many side-issues; and I will certainly not be drawn into any correspondence about them, for this might last out the war, or until the powers that be intimate that "This discussion is now closed."

Leaving the war out of account, the tar distillers, after all, are working their own business for their own ends; and it is up-against the gas undertakings to do the same in future. If they are under the impression that they are not being justly treated, the remedy appears to be in their own hands, and it ought to be easy to create such a condition of affairs as will ensure the best results for the industry. And let me say, in common fairness, that some of the complaints of the gas undertakings are one-sided. What of the engineer who complains that his quoted price from the tar distillers is governed by his distance from any competitive works, while he cheerfully puts up his price for treated tar to the road authorities on exactly the same basis.

It is satisfactory to learn that the Treasury have given the Road Board powers to spend a considerable sum on the roads; for this will mean the utilization of a certain amount of tar, and also more comfort to road users.

PITCH.

The accumulation of creosote oil is one of the effects of "war" business, when tank-waggons and ships are suddenly called upon to do infinitely more work. This must be made the best of; for we must remember in all I have said, and in all I am going to say, that "we are at war."

Pitch is in a different position; the war has closed the principal markets. But pitch stocks are, in one way, more easily handled than creosote oil; for pitch can be stocked in the open, and does not need expensive storage tanks. No doubt, it means storing unremunerative money as well, and extra costs in handling. Pitch is best stored in the open; for, like a recent writer, I have seen it placed in an old coal-store (next to a retort-house), and it is rapidly trying to prove that it should have been stored in a more suitable place to meet its natural desire to "keep moving." Any practical suggestion for the utilization of pitch will have general attention paid to it at the present time. Many workers are in the field.

The carbonization of pitch in gas-works or coke-ovens is being investigated by various persons; and some definite rules may soon be the outcome. As regards gas-works practice, it would appear that a 5 per cent. mixture of pitch is the safe limit. It does not materially improve the results secured from the coal alone; but it is claimed that its use improves the coke. This is what might be expected, when a hard pitch is used. With a softer pitch, the results should be better. The pitch should be broken-down as finely as possible, and thoroughly mixed with the coal. This necessary procedure can be understood. Larger pieces would "run;" but smaller pieces, when melted, would be more easily absorbed and held in position by the adjacent small coal. Most trouble has been found by the mixed material "clogging" on to internal chargers; but such methods as De Brouwer charging and shovel charging are not subjected to this. In normal times, and with pitch at normal prices, its use might not be justified; but at present prices, and because of the far-reaching effects of a reduced pitch stock, it is certainly necessary for every one of us to give the question his serious consideration.

A firm of tar distillers has informed me that they are successfully burning pitch under their boilers. In answer to further inquiries, I am informed that there is a percentage mixture of heavy oils with it. I have been invited to see the process, but have not yet been able to do so. I venture to suggest the possibilities of fitting furnaces with an interior pitch-melting plant. The furnace could be started with sprayed creosote oil, until the necessary heat was obtained; and then a spray of melted pitch and creosote, in proportions to be determined, could be sprayed by compressed air from a suitable nozzle. In closing-down, the pitch could be shut off before the temperature fell.

THE CALORIFIC STANDARD.

All the signs point to the fact that the gas of the future will be judged on a calorific basis; and present opinion points to a standard of 500 B.Th.U. gross. It is obvious that the recently-imposed neutral zone of 500 to 540 B.Th.U., with penalties at 500 B.Th.U. is absurd; since the published tests show that the 500 B.Th.U. penalty limit is the only one which is seriously taken into account.

The 500 B.Th.U. standard allows reasonable facilities to the flat-flame burner users. For years they have had consideration beyond their merits. In the majority of instances, incandescent burners would give better and cheaper service; and in these cases there has been a long course of education available, but unapplied. I grant that in some instances flat-flame burners are necessary; but in nearly all these cases they are in workshops, and in groups, and are not isolated burners. It should be easy to fit local carburettors to meet such peculiar conditions. When one comes across the statement of a large company that 99 per cent. of their gas is used for its heating value, it is difficult to understand why such consideration should be given to the 1 per cent. Surely, it should be as easy to instal a carburettor as it is to lay down a compressor; and economy for the majority should be better business than pandering to the minority.

When dealing with the "gas of the future"—which, as I have said, I anticipate will be of a calorific value of 500 B.Th.U.—it will be essential for great care to be paid to the purification and composition of the gas. It ought not to pay to carry inert gases through an expensive distribution system and use some portion of "live" gas in heating them up for no useful purpose.

MAKE ALL NEEDFUL SACRIFICES.

Coming back from the future to the present time, I should not like it to be assumed, from the remarks in the earlier part of this address, that, because the demand for benzol has grown to such proportions, the demand for toluol has ceased. That is not by any means the case; and it is up-against everyone during the trying ordeal through which the country is passing to do all he can in the way of producing both benzol and toluol. It is hardly necessary for me to point out to you how much greater is the extent of the good work that can be accomplished if there is hearty co-operation between an engineer and his directors. It is surprising to find the great variations there are in the opinions of those connected with different undertakings as to what they can and what they cannot do; and one cannot help feeling that some part of this difference would disappear if the needs of the case were as fully realized in some cases as in others. While the interests of the shareholders and of the consumers must, of course, receive due consideration, the immediate question we have to ask ourselves, and to answer, is: "What efforts and what sacrifices can we make, in order to help to bring the war to a successful termination?"

Let me not be misunderstood. The gas industry has come nobly to the assistance of the country; and it is the very fact that it has come forward so readily which emboldens me to urge upon all to try and do still more.

THE REWARD.

This patriotic work will not go without its reward. Indeed, I am strongly of opinion that the sacrifices which the gas undertakings are making at the present time will result, in the future, in great benefit to them. With all this good work to their credit, the gas undertakings must be better recognized and more generously treated by the Government than they have been in the past; while even the experiences gained by the alterations in candle power, &c., which to a more or less extent have resulted from oil and tar washing, will have their advantage in serving to convince Parliamentary Committees of the advisability of granting standards which will enable consumers to be efficiently supplied with gas on the most economical basis possible. One thing certain is, that if the country is to have a future at all, every trade will have to look more carefully than hitherto into the questions of economy with regard to methods of production.

CHEMICAL MANUFACTURERS AND RESIDUAL CLAUSES.

There is another direction, too, in which the war should tend to enlighten Parliament. I think it will show them that they have done wrong in departing from the decision of the Joint Committee of the two Houses who came to the conclusion that gas-works should have a free hand in the matter of working-up residual products, whether produced in their own plant or bought from other undertakings. It must be obvious that it would not be economical for every gas-works to instal (say) a complete tar distillation plant or an acid-making plant, or even, in some cases, a sulphate of ammonia plant; and I cannot conceive that any Committee in the future will find it possible, in reason, to object to giving permission to gas undertakings to make their own arrangements for dealing with residuals as they may think best. In this connection, there may yet be some interesting evidence given in regard to the relations between tar distillers and gas undertakings.

I would venture to express the hope that the attitude of the chemical manufacturers may undergo such a complete change that, instead of opposing the reasonable efforts on the part of the gas undertakings, they will come along and, from feelings of patriotism and fairness, will assist the undertakings to secure the powers they so evidently require for the country's good.

FUTURE OF LABOUR.

The question of the future of labour is present in all our minds, and well it may be; for it probably will be the greatest and most difficult question which will have to be faced. It would not be wise to put down in print all we hope and all we fear; but the introduction of labour-saving machinery wherever possible is a safe recommendation.

REMUNERATION OF ENGINEERS.

As a "free lance," with no axe to grind, I may be allowed to express a hope that directors and committees, who have been so generous to their workmen, will not forget their engineers at the proper time. They are, like everyone else, feeling the burden of increased cost of living and taxation, and, in addition, have had, and are having, a most anxious time; and it is largely due to them that things are kept going.

THE FINAL WORD.

Many other topics might have been touched upon; but I have imposed a time-limit on myself. The general rule at the spring meeting has been to have general business and the President's Address. To-day we have, in addition, two papers on engineering subjects; and I cannot occupy more time without being unfair to the writers of the papers. If I have kept you too close to the war, the other part of the programme will come as a relief.

A Vote of Thanks to the President.

Mr. A. F. Browne (Vauxhall) said he felt that he was a privileged individual in having been given an opportunity to move a very hearty vote of thanks to their President for his most patriotic, instructive, encouraging, and entirely up-to-date Presidential Address. There was a rule that it was not good form to criticize a Presidential Address; but he must say that from the very first paragraph, he was profoundly impressed with the patriotic tone, which was continued in the other parts. The members need not assure Mr. Gibb of the pleasure it gave them to see him occupying the chair of the Association. One of the previous speakers had referred in a very nice way to their President having occupied the chair of the Institution of Gas Engineers, which was the highest honour it was in the power of his professional colleagues to place upon him. Mr. Gibb had lived some years since that time. He (Mr. Browne) remembered his occupation of the chair very well. The experience he then had had already been wide; and it had since become wider still. He thought the members were very fortunate in being able to send Mr. Gibb back again to the Council of the Institution, where, he was sure, he would do fully as useful work as he did in the old days. They were also fortunate, from the point of view of the social side, in having secured Mr. Gibb as their President. Those who had the privilege of knowing him as thoroughly as he did, were fully aware of the charming and genial side he possessed, and what an all-round good fellow (if he might respectfully use such a term) he was. He thought the High Explosives Committee were to be highly congratulated upon having, during this war crisis, obtained the services of Mr. Gibb, who was so thoroughly acquainted with the gas industry. There was much in the address which would be useful to them all and to the industry.

Mr. F. W. Cross (Lea Bridge), in seconding the motion, said that, towards the close of the address, the President remarked that he had cut it short, in order to leave room for the discussion of the two papers; and it then flashed across his (Mr. Cross's) mind what a lovely paper the address itself would have made for discussion. There were topics throughout it which made one think of discussion.

The motion was carried with acclamation.

The President thanked both Mr. Browne and Mr. Cross for the very kind things they had said. Especially gratifying to him were Mr. Browne's remarks; and some part of the gratification was due to the fact that, he thought he might say, they were tried friends. It had been a source of gratification to him since he came to London to always know that in Mr. Browne he had one of his greatest friends, and one whose advice he knew he could ever have at hand, and whose advice he always knew would be absolutely sound in every particular. He thanked Mr. Browne also for his reference to a personal side of his (Mr. Gibb's) character. If it was true he had a bright social side, and he could carry it along with him into what Mr. Browne mentioned in his next expression—high explosives—it would appear that he (the President) was fairly evenly balanced. [Laughter.]

The May Meeting.

The President observed that there was one informal matter to which he had to refer. In peaceful times, there had always been a May meeting, which was looked upon as a trip meeting. The Committee were rather doubtful as to what might be the best thing to do under the circumstances of this year. Various suggestions had been made. One was for them to have a visit to a place in London or the neighbourhood, and then, instead of having a programme especially arranged, have informal discussions upon various subjects. For instance, members might send in some suggestions, and the Committee from them might select half-a-dozen suitable topics. Then the members could be prepared to have a regular "dust-up" upon the questions selected. The matter was, however, left quite indefinite. It had also been suggested that perhaps arrangements could be made for the members to go over a Government factory. It was difficult enough at the present time to get one or two people through a Government factory, but to get sixty or eighty through, he was afraid, was not possible. However, if the arrangements for the May meeting were left to the Committee, they would do the best possible under the circumstances.

Papers and Discussions.

[See Pages 637-42].

The two papers held over from the previous meeting were then read and discussed. They were by:

Mr. F. Durkin, on "Extensions at the Southampton Gas-Works."

Mr. W. D. Child, on the "Construction of Concrete Purifiers at Romford in 1913."

It was mentioned by the President that Mr. Child unfortunately could not be with them that day. He was in hospital at the present time, but was progressing well. Mr. Durkin's paper would be taken first; and Mr. Child's paper would then be read by the Hon. Secretary.

At the close of the discussion on the papers,

Mr. Samuel Glover proposed a vote of thanks to the authors. In Mr. Child's absence, he thought it was only justice to him to say (and he knew Mr. Broadberry would understand) that they should keep in mind the fact that he did not build his design of concrete purifier box as an example for Mr. Broadberry to go by for works of his size. Mr. Child had put in these small boxes for works of the size at Romford. He had utilized the thrust of the earth to help to hold them in their place, and to get support for all the weight of cement which he got in at the bottom, and the thrust on the outer side walls was also carried back to the ground. Mr. Child had been good enough to, as Mr. Broadberry said, offer his experience of what he had done at the Romford works under the circumstances in which he was placed; and they were obliged to him. It was quite evident they were to hear more of this subject. He would suggest that the continued gas-tightness that had been looked for in the boxes should be carefully studied—as to whether the "Ironite" used would not suffer with the chemical reactions that went on inside the box, and would no longer remain "Ironite" as put on the inside of the box when new. If with their ordinary boxes the iron was eaten away, and nothing but the carbon of the iron was left behind, he did not know how the "Ironite" was going to maintain a gas-tight hold of the surface of the concrete boxes. He thought this was one of the points they might fear—that, although they started with a gas-tight concrete box, it might not remain gas-tight, unless the pores of the concrete gradually became stopped up. If they wanted a gas-tight concrete box, why not put an elastic gas and water tight lining between the inner and the outer coatings of concrete, as some of them had done in making gasholder tanks water-tight?—for instance, some elastic pitch or asphaltum, which could be continued from the bottom layer to the top layer, and so make an absolutely water and gas tight envelope. No reaction could get to it to affect it or to get it out of its place. . To the authors of the papers, they tendered their heartiest thanks.

Mr. G. M. Gill (South Metropolitan Gas Company), in seconding, said both papers would be valuable for record purposes. As a matter of interest, he might mention that many years before reinforced concrete was introduced, Mr. Henry Jones constructed some concrete purifiers at the Wapping Gas-Works; and these did good service for a number of years. He had heard that ordinary concrete was used, and that the boxes were not absolutely gas-tight. As the walls of the purifiers formed the boundary wall of the works, he believed it was a favourite amusement of the small boys in the street to light up the little jets of gas escaping outside.

The President mentioned that a message had been sent to Mr. Child regretting the cause of his inability to be present.

The motion was heartily passed.

Mr. Durkin having thanked the members, the business proceedings terminated.

The members afterwards had tea together, over which some time was spent in friendly intercourse.

Army Contractors and Badges.

It was pointed out by the War Office, in a statement issued at the end of last week, that in granting badges for the purpose of protecting the indispensable labour of firms engaged on important contracts for them, the importance has never been overlooked of securing every available man for the army; and, as a matter of fact, when the Derby scheme was started, the issuing of badges was to a great extent abandoned, in favour of the alternative plan of attesting and appealing when called up. Firms adopting the latter policy received a letter, which could be shown to the Tribunal, pointing out that they held contracts for the War Office which must not be jeopardized, but also stating that the indispensability of any individual must be determined by the Tribunal. It has now been resolved to withdraw from contractors any badges which may be found to be no longer required; and to attain this end, a systematic inspection is being made in the case of firms whose employees have received badges. In this connection, it seems, the officials have been instructed to pay special attention to the necessity of withdrawing badges from eligible single men in all cases where they can be replaced by men over age or otherwise disqualified for service, or by women. In certain quarters, the suggestion has been made that the issue of the letter may have led the Tribunals to adopt a too liberal policy of exemption; and therefore all firms to whom the letter was sent are also being visited, to make sure that only men absolutely indispensable for war work have been put back. Further badges will only be issued in cases in which the Army Contract Department have satisfied themselves by inquiry as to the indispensability of the men for whom the badges are desired.

Sulphate of Ammonia Export Prohibition.—According to Saturday's "Chemical Trade Journal," at a recent meeting of the Council of the Newcastle Chamber of Commerce the Secretary announced that he had ascertained that the prohibition of the export of sulphate of ammonia would remain in force for at least two months.

Proposed French Patent Legislation.—There has been published, says the "Board of Trade Journal," the text of a Bill introduced into the Chamber of Deputies by the Minister of Commerce which has for its object the extension of the legal periods for which certain patents would normally remain in force. The Bill provides that the duration of patents of invention which, in the normal course of things, would have expired on or after Aug. 1, 1914, or which would have expired before a date to be fixed by Decree after the cessation of hostilities, will be extended until a date to be named by the same Decree. At the same time, those who, in good faith, before the promulgation of the proposed law, have infringed a patent to which the law will apply, will not be liable to be proceeded against, nor will they be bound to cease working the invention.

EXTENSIONS AND IMPROVEMENTS AT THE SOUTHAMPTON GAS-WORKS.

By F. Durkin.

[A Paper Read before the Southern District Association of Gas Engineers and Managers, March 16.]

It may be of some interest to members to describe the extensions and improvements to the carbonizing plant of the Company with whom I am connected, and a comparison of the results obtained. It is frequently by independent testimony of working results contributed by members of Associations, that others may be helped to some decision when they have to extend their plant.

Stoking Machinery.

Up to August, 1907, we only had hand-charging by scoop work. Stoking machinery had been considered on more than one occasion; but to have adopted it in all the retort-houses would have been costly—necessitating a machine in each of two for only eight settings each, all circular retorts, 16 inches diameter and 20 feet through. Another house of twelve settings of the same description of retorts was eventually adapted in the year 1907 for machine stoking by De Brouwer's arrangement, and was the means of some saving. But it still necessitated hand-charging as well in the other houses some part of the year; and all the coke therefrom was dealt with by hand labour.

Horizontal v. Vertical Retorts.

The time came, however, owing to increased wages, for something more to be done; and I was requested to go into the matter. In 1912, it was finally decided, after due consideration of the merits of both horizontals and verticals, to build a new retort-house for 20 feet through horizontal retorts (on account of their known advantages over verticals), and with regenerative furnaces. It was felt that their working was a certainty with the half-dozen kinds of Durham coals carbonized against a somewhat limited knowledge of the more recent rival, and that the other houses might at some future time be adapted for verticals, when a more extended knowledge of their working and duration would possibly be known.

Skeleton plans were prepared, showing the site and outlines of the buildings (with dimensions), to give some idea of what was required.

Three firms were invited to tender and submit designs. One, that of Messrs. Aldridge and Rankin, was selected, which seemed to best fill our requirements.

The Retort-House.

The land available for the extension enabled the following erections, constructed on concrete foundations, starting on the gravel 4 to 5 feet below the ground line, for supporting the more important parts of the building and settings, and arched beds of concrete of less thickness at other points started on the solid ground, with the before mentioned for abutments.

A steel-framed stage-floor retort-house was erected, 209 ft. 2 in. long by 57 ft. 8 in. wide, inside dimensions, by 41 ft. 6 in. from ground line to eaves; a suitable arrangement being employed to allow for expansion and contraction of the benches and stage floor, &c., free of the main building. **H** section steel standards support the roof principals. The roof is boarded and slated, with a ventilator the length of the house along the line of the ridge.

Brickwork filling is provided for the sides and ends of the house, and piers formed at each standard, with 4½ break inside and out, set in cement where in contact with ironwork, and 9-inch panelling between, bonded, and set in mortar. Suitable openings for ventilation are formed in the panels of the front elevation, with semi-circular arches, 9 inches deep, in rubbed bricks, and a concrete keystone to give the front elevation a finish.

There are three benches, 61 ft. 6 in. by 20 ft., each with its own chimney, 70 feet high from the ground level, separate from each other and the end walls. In front of the settings there is a space of 20 feet on the machine side, and 17 feet on the discharging side to the side walls. Six settings in each bench contain eight ⌓ retorts 23 in. by 16 in. in four tiers, and a furnace to each, fed on the discharging side. These settings have worked very satisfactorily, giving an equal heating throughout.

The capacity of the house is about 192 tons per day. The duration of the charges is eight hours for the three upper tiers, and twelve hours for the bottom row. The area of the retort-house is 62½ square feet per ton of coal carbonized.

Coal Store Adjoining.

This is excavated 8 ft. below the ground line, and is 209 ft. 2 in. long by 30 ft. 1 in. wide by 15 ft. 6 in. deep. It has a separate roof from the retort-house; the 9-inch division wall being common to both. The exterior walls are plain; piers enclose the steel standards; and 9-inch panelling between, with large openings for ventilation in the coal-store so as to economize brickwork. The store holds 3500 tons of coal, and thus the area per ton of coal carbonized is 33 square feet.

A coal breaker and elevator, arranged near the middle of the store, handle about 20 tons per hour. A telpher grab, with a capacity of 22 cwt., feeds the breaker; and a track all round the store enables coal to be picked-up from almost any point. During the delivery of coal from a steamer, the breaker is fed by side-tipping waggons, and the telpher is used for stacking the coal. The elevator delivers coal on to either one of the two sections of conveyors (of push-plate type) in line with the three sets of continuous hoppers holding, when full, 12 hours' supply. The stoking machine is the Fiddes-Aldridge simultaneous discharging charger, and actuates the coal-hopper doors in its travel, taking in the charge from the overhead hoppers for each retort.

The mouthpieces are self-sealing, with screw-tightening for the three lower tiers, and lever type for the upper. The ascension-pipes are 6 inches diameter on both sides. The dip-pipe ends are bevelled, and all of one length. The hydraulics are of the sloping bottom type, with two settings to a section, supported on cross girders, which also form ties to the buckstaves. The 6-inch tar and liquor pipes connect-up each section of the hydraulics, and fall to the tar-towers fixed at the end of each bench, with a seal regulating valve on each tower. At the stage floor, tar draw-off valves drain into tundishes; the latter connecting to drains falling to the underground tank. Along the centre of each bench a 15-inch steel main connects with branches having valves to each section of the hydraulic for the gas take-off. On the outlet of each steel main there is a 10-inch governor with inlet, outlet, and bye-pass valves connecting to a 20-inch branch, thence to a 30-inch conducting main extending the length of the house.

Coke Handling.

Coke handling is done by means of a telpher, the track for which extends the length of the house, and curves out of it on the side near each end. Owing to the curves, track points had to be used to deal with coke from the end settings. Coke is quenched

THE TELPHER PLANT AND COKE-QUENCHING PLANT AT SOUTHAMPTON.

in a cast-iron tank outside at each end, but is by no means an ideal arrangement.

The telpher track outside the retort-house forms a circuit of the coke yard, and coke is deposited either to the heap, or screened on a jigging conveyor before dropping into ferro-concrete bunkers underneath, arranged to catch breeze, coke of broken size, and large coke.

POWER.

The whole of the plant is electrically driven; power being generated by a 95 B.H.P. gas-engine, with flexible direct-coupling to a 50 KW. dynamo. A mechanical water cooler, driven off the engine-shaft is used for cooling the circulating water for the engine jacket. A duplicate power set has recently been installed.

The work was carried out under one contractor. It was commenced in the autumn of 1912, and the first bench charged in September, 1913.

RESULTS OF WORKING.

The comparison of results between the old working and the new is as follows.

The average production per ton for the half year prior to the starting of the plant in the direct-fired settings was 12,000 cubic feet; in the half year to June 30, 1915, it was 13,500 cubic feet; and in the six months to Dec. 31, 1915, it was 14,000 cubic feet.

Average cost of hand charging .	5d. per 1000 cubic feet
Average cost of machine and hand charging	4·11d. ,, ,,
First half of 1915, machine only	1·21d. ,, ,,
Second half	1·18d. ,, ,,
Fuel used, direct fires . . .	Over 30 per cent. of the coke made
Fuel used, regenerators . . .	15 to 16 ,, ,, ,,

A corresponding advantage has been gained for coke and breeze sold per ton of coal carbonized by at least 2 cwt. more.

A Twenty-Four Hours' Test on the New Plant.

July, 1914.

Illuminating power	12½ candle power, No. 2 "Metropolitan"
Calorific value	510 B.Th.U. gross
Production	12,000 cubic feet

May, 1915.

Illuminating power	12·4 candle power, No. 2 "Metropolitan"
Calorific value	508 B.Th.U. gross
Production	14,500 cubic feet

October, 1915.

Illuminating power	13·0 candle power, No. 2 "Metropolitan"
Calorific value	510 B.Th.U. gross
Production	14,500 cubic feet

Three gangs of men are employed per 24 hours. Each gang consists of a foreman and eight men for charging and discharging operations. Coal handling requires two men during the daytime only.

I think you will agree that these figures justified the extension; and it is a fortunate circumstance to have completed the work before the present labour difficulty.

GENERAL REFLECTIONS.

With regard to the regulation of the heat in the settings, I wish to record the advantage we have derived by the use of the Fery pyrometer.

Figures published of the make per ton produced by various undertakings rarely state what coals are carbonized. My first question when any comparison is made is to know this point; for it is hardly fair to compare the results of an undertaking using (say) South Yorkshire coal with another works using a poorer kind. One should get good results easily; the other hardly hopes to get the same results even with close attention to the working of the retort-house. But the result given above at any rate for the production per ton is not so far behind.

On the matter, too, of production per ton, I am not sure what the general practice is. But with large stocks of coal, it seems advisable to work for some margin over and above book stock for emergencies, and only show a moderate rather than a full production.

For a good many years, we were satisfied with having a jet photometer at the outlet of the purifiers; and then some years later it was adopted at the outlet of the exhausters. But a good deal may happen between the retorts and exhausters. On one occasion I remember some settings were charged in the early afternoon; the hydraulics had been examined and water-lined in the morning; but for some unexplained reason the water was not there; hence the jet told the tale of something wrong at a fairly early stage. But how much better it would have been if the same jet had been at the outlet of the bench, and saved yards of the condensing mains from being filled with a poor mixture, to say nothing of what may happen at the purifiers.

The difficulty is that the outlet main from the settings is under a vacuum; but I am glad to say this has been overcome in our case. With some suggestions from myself, two of my assistants have devised means to give pressure to operate a jet photometer, also a water-weighted retort-house governor having a loading and unloading device controlled from the stage floor. The jet photometer indicates the quality, and a vacuum recording gauge shows the pull on the inlet of the governor. It has proved an ideal arrangement for the control of quality and make per ton.

When a series of retorts are charged, gas is evolved over a period at a rapid rate. By means of the above apparatus, the governor is regulated to cope with it; and the gas leaves the retort quickly, without an accumulation of pressure within the retorts. Thus over some periods as much as 15·10ths to 20·10ths vacuum can be maintained.

When the rush of gas is over, the jet indicates it, and the governor is operated accordingly.

DISCUSSION.

Mr. C. F. BOTLEY (Hastings) said that he thought it might be fairly granted that, as compared with hand-charging, Mr. Durkin had more than proved the case for his new plant. But there were one or two points upon which he (Mr. Botley) would like some further information from the educational point of view. He imagined that in the one house the De Brouwer arrangement was confined to discharging, and that the charging was done by hand. [This was corrected by Mr. Durkin in his reply.] In regard to the general figures, it was always useful for one to compare the results of any works with his own. It happened that his retort-house was of very much the same capacity as that Mr. Durkin had erected; but the Southampton house was built for machinery on one side only, while the house at Hastings was designed for utilizing machines on both sides, and even for verticals, if thought expedient, one of these days. The result was that his square feet per ton of coal carbonized was considerably in excess of that at Southampton; and the same remark applied to the provision for coal storage—45 square feet, as against Mr. Durkin's 33 square feet. The methods of handling coal differed in various works. In his own case, the coal came in trucks, and was discharged direct into the retort-house; and it was not his habit to work in and out of stock. He believed that at Southampton, the coal came in by steamer; and they had to work in and out of stock, and the design was made to suit this condition. He was, however, struck by Mr. Durkin's low cost for coal handling. This was done very cheaply indeed. There were only two men to keep the house going; and they did all that was necessary within ten hours' work, or apparently so. He should like to have the actual cost per ton. In regard to coke handling, he should like Mr. Durkin to tell them whether he found the operation of the telpher caused any delay in the working of the house. Also what was his production of breeze per ton; and in what respect he was condemning the method he employed of entirely dipping the skip for quenching in a tank outside the retort-house. As to the results given in the paper, it was a wonderful record of what could be done by strict application of modern principles to the working of a retort-house. He took it that these results were largely due to the contrivances that Mr. Durkin and his assistants had introduced. In these days, he thought they were all aiming at getting the best calorific value out of the coal carbonized. It was their duty to do so; and thereby do the best possible for their undertakings, and help to husband the coal resources of the country. Taking the tests as given, he had worked out the figures on the B.Th.U. per ton basis. He found that in July, 1914, the figure was 6,120,000 B.Th.U. per ton; and in October, 1915, it was up to 7,395,000 B.Th.U. per ton. This was a remarkable result; and he took it that it was open to most of them to get a step forward in this respect. But if one wanted information on a matter of this kind, it should be upon a proper basis; and it was therefore necessary to know what coal was being used. He also preferred to take figures for a half year, rather than for an isolated test, or even for the various periods Mr. Durkin had taken. Last half year, using such Durham, Yorkshire, and other sorts of coal as he could obtain (he really did not know what some of it was), he got per ton 12,600 cubic feet of 13-candle gas; but this did not compare with Mr. Durkin's figures on the calorific basis. He remembered a test that Mr. Thomas Goulden conducted on the calorific basis to see what could be done in making 12-candle gas. He believed the highest figure he obtained per ton of coal was 8,395,000 B.Th.U.* Mr. Durkin was to be heartily congratulated upon the results he had achieved.

Mr. F. W. CROSS (Lea Bridge) remarked that Mr. Botley had mentioned that the super-area of his house was higher than that of Mr. Durkin. As a matter of interest, he (Mr. Cross) worked out the super-area of his vertical retort-house that morning; and it came out at 36 super feet per ton. This was a matter of interest rather than of criticism. As to the average costs that Mr. Durkin gave, he should like to know what he included as charges. It was rather important they should know how far he went with his wages bill, because a total figure conveyed nothing to them unless they knew something as to the constituent items.

Mr. W. N. WESTLAKE (Exeter) congratulated Mr. Durkin on the results he had achieved. To have reduced his labour charges from 5d. per 1000 cubic feet to 1·21d. was an attainment of which he might be rightly proud. This tended to reduce the cost of the gas, and thus to extend its use. He (Mr. Westlake) had recently had some experience with improved plant. But unfortunately he had not had an opportunity of making a long test, because the plant was only sufficient for part of their make; and it was only in the summer he had an opportunity of making anything like a complete test. His experience with hand charging compared very favourably with that of Mr. Durkin. It used to cost him 5d. They got it down (not, however, in war time) to slightly over 2½d. During a month's test of the new vertical plant last summer, they were able to get the labour charges down to 1·16d. per 1000 cubic feet made; and at that time the whole of the bench was not in operation, because they then only required about four-fifths of the gas that it would produce. The figure was the actual wages paid for the month; and it included the stokers, scurfers, and exhauster men. Mr. Durkin might like to know this. If the output of gas had been sufficient in that month to have utilized the whole of the bench, the labour charges would have been down to about 1·04d. per 1000 cubic feet, because they would not have wanted any more men for the extra output.

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* See Presidential Address to the Eastern Counties Gas Managers' Association in October, 1913.

The President (Mr. W. Doig Gibb) added his compliments to Mr. Durkin for having written such an interesting paper. It was one that appealed to every one of the members. Upon the question of horizontal *v.* vertical retorts, he expected to have heard an animated discussion. Applicability of system largely resolved itself into a question of the relative size of the works. One point in favour of verticals was that they were self-contained; and therefore in a place where extensive machinery could not be applied, it might be quite proper to make a vertical installation. A vertical installation for a given output also occupied less ground space; and this was a consideration, if they were hampered for room. Every different question had to be weighed on its own merits. If Mr. Durkin would allow him to say so, he did think the time had passed when it could be said that the experience of the working of verticals was so limited as not to justify anyone going in for them if conditions pointed to them being a paying acquisition.

Mr. W. E. Price (Hampton Wick) asked Mr. Durkin if he would explain the last but one paragraph, as to the means devised to give pressure in the retort-house.

Mr. Durkin, in reply, said in reference to Mr. Botley's remarks, he thought he made it quite clear that the De Brouwer machinery comprised a charger and discharger. With regard to the coke telpher, it did not delay the operations. When the charge started, the skip came in; and the spent charge from the first retort was pushed into it. During the time the telpher was away, the charge from the next retort was pushed into the furnace.

Mr. Botley: How long is the telpher away?

Mr. Durkin said he had not timed it, but possibly between two and three minutes. With regard to breeze, he was sorry to say they made rather a lot, due to two things—the drop of the coke into the skip, and the cooling by water in the tank. The skip being lowered into the water broke the coke down very much, and shot it all over the place. Consequently, there was a lot of breeze with which to deal. A question was asked as to the kinds of coal he used. They were principally West Leverson, Pelton Main, and Holmside; and quite occasionally Thornley, Wearmouth, and Horden. There were, therefore, half-a-dozen Durham coals, which were handled in any proportion they liked. Holmside coals were found to be the best. As to the costs per 1000 cubic feet, they had three gangs of eight men (including the foreman), and the coal was handled by two men. As to Mr. Westlake's remarks, there was a difference between the wages in a seaport town and an inland town. In the former, the wages were naturally higher. Mr. Price asked a question about the pressure in the retort-house. Some time ago he wrote to a firm asking them if they could recommend him some means of producing pressure in the retort-house. They suggested a small water-motor. This did not quite meet the idea, because it required some sort of motive power. The pressure was now produced by water. He did not think it was divulging any secret to say that it was on the principle of the water-pump—a jet of water being made to produce the pressure of the gas. He might remark incidentally that the water, being in contact with the gas, took out a little of the ammonia.

CONSTRUCTION OF CONCRETE PURIFIERS AT ROMFORD IN 1913.

By W. D. Child.

[A Paper Read before the Southern District Association of Gas Engineers and Managers, March 16.]

I had for some time given consideration to the question as to whether the construction of purifiers in their simplest form—*i.e.*, when resting upon or sunk into the ground—might not be more economically effected by the use of portland cement concrete than with the usual cast-iron plates.

Having become acquainted with the "Winget" concrete block-making machine and the variety of material that may be produced by its use, I resolved to go more closely into the question of the cost of concrete construction. By using suitable proportions of crushed clinkers, breeze, sand, and portland cement, I found that blocks measuring 32 in. by 9 in. by 9 in. could be produced at a cost of 10d. each, and quoin blocks, closers, and other shapes at proportionate rates. By the use of these blocks, the construction of the purifier boxes would be carried out without the erection of any timber framework, or shuttering, and in this way, considerable economy would be effected.

During the winter of 1912, the make of gas at Romford had increased to such an extent that the oxide purifiers, 16 ft. by 16 ft., then in use, would only run about 24 to 30 hours without requiring to be changed—principally on account of heavy back-pressure, which would rise as high as 28 inches, with great risk of gas blowing at the water-lutes of the boxes in which the covers were sealed. These purifiers were erected when the works were built in 1892, at which period the make of gas was about 30 million cubic feet per annum.

I therefore prepared plans and estimates for the construction of a set of four concrete purifiers, each 30 ft. by 20 ft. by 5 ft. 6 in. internal dimensions, with 18-inch cast-iron pipe connections to a Weck valve. Having submitted these plans, &c., to the Directors of the Company, and secured their approval, tenders were invited for the necessary cast-iron coping plates, steel luteless covers, Weck valve, connections, &c. The work was put in hand in June, 1913; the Company undertaking the erection of the concrete boxes, while the ironwork was in the hands of well-known contractors.

An excavation was made approximately 88 ft. long by 33 ft. 2 in. wide and 6 ft. deep; the sides being cut truly vertical, and the bottom accurately level. Over the whole surface of this bottom, portland cement concrete, 18 inches thick, was placed in two layers, each 9 inches thick.

To ensure a level bottom, two parallel lines of 9 in. by 3 in. deals were placed 16 feet apart along the whole middle length of the excavation, the upper edges of the deals being truly level. This centre portion of the bottom was completed first, and when set served as a guide for putting in the side widths.

The 9 in. by 3 in. deals were then again placed in position 15 feet apart, so as to break-joint with the bottom layer; and in placing the concrete in position, the surface was at once faced with a finer and richer concrete, so as to form a conglomerate mass of perfectly level concrete, requiring no surface rendering—the latter having a tendency to scale-off. Upon this level bottom, the outside and the division walls were distinctly marked out, and the builders commenced setting the concrete blocks.

The outer walls were faced on the inside with blocks 9 inches deep and 9 inches wide, with quoin blocks built in to bond with the division walls; and these blocks were backed-up to the solid earth with 9 inches of mass concrete. This was put in when each two courses of blocks had been set in position.

The division walls were built with blocks 9 inches deep by 8 inches wide, set 2 inches apart; the space being filled in with portland cement grout, forming a solid wall 18 inches thick. When the work arrived at the proper height, this space was used to receive the holding-down bolts of the cast-iron coping plates. The bolts, being accurately placed in position, were then grouted-in solid.

At the positions shown on the photos., two courses of Staffordshire blue brick were built into the walls with 2-inch projection; and these served to support the ends of grids carrying the purifying material. The bearing bars for the wood grids are supported on concrete corbel blocks, built into the walls.

As soon as the walls were raised to the full height, the upper surface was rendered with good portland cement compo ¾ inch thick; and when this had thoroughly set and dried, it was painted with boiled oil to form an adhesive surface for the jointing material used in bedding the cast-iron coping plates.

To ensure the concrete walls of the boxes being gas-tight, the whole of the inner surface was dressed with "Ironite." This material is, I believe, composed of the finest iron dust that can be separated from cast-iron borings by a blast of air at a pressure sufficient to blow the fine particles, having a certain gravity, into a receiver, as the borings are poured down in front of the air-nozzle.

The iron dust is no doubt mixed with sal ammoniac, &c., in the same way that borings are prepared for an ordinary rust joint. The "Ironite" is mixed with water in a pan in small quantities, kept constantly stirred, and applied to the face of concrete with a stiff brush, stippling it well into the pores of the concrete. For the work in question, I used two coats—allowing the first coat to rust and dry before applying the second—and in this way secured a sound job.

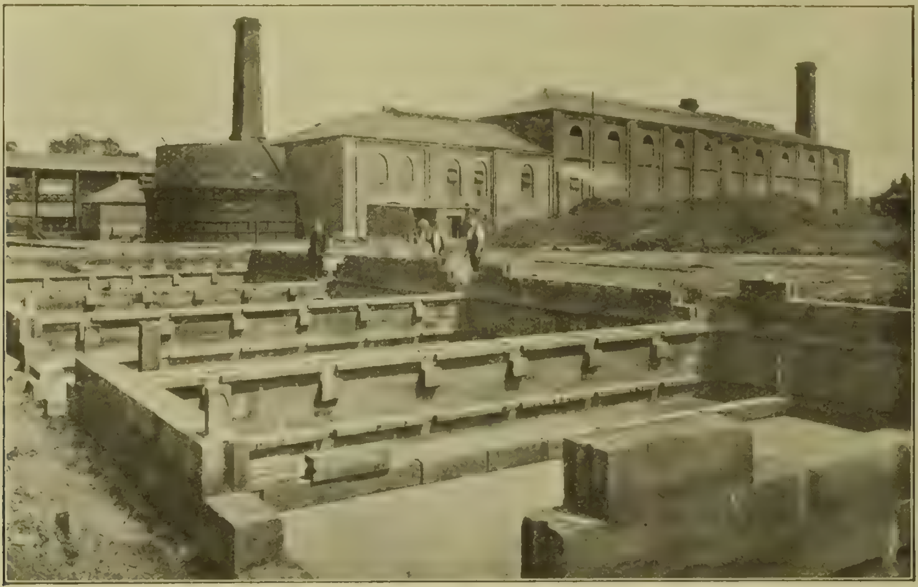
I used the "Ironite" in preference to cement rendering. The method of application fills up all cavities in the concrete, and chemical and mechanical union takes place between the "Ironite" and the surrounding surface with but little probability of any subsequent parting, as frequently occurs with cement rendering.

Coping Plates.

The coping plates of cast-iron were designed (as shown in the photos.) about 5 feet in length and 1 ft. 9 in. wide, with a rounded nosing overlapping the outer edge of the wall. The inner edge of the plate was turned upwards, raised slightly above the depth of the flanges, and planed to a true surface, to form a continuous bearing for the jointing material of the luteless covers. Guide pins were accurately fitted and driven in, to bring the bearing surfaces truly together, when the plates were bolted in position.

The jointing material used for the covers was a specially prepared hemp gaskin, 1½ in. by 1 in., square section, with tallow worked in, in the course of manufacture.

The boxes were divided longitudinally by a gangway, formed with two 15 in. by 4 in. by ½ in. steel channels (weight 42 lbs. per foot run) riveted together, and with 5 in. by 4 in. by ½ in. angles, riveted to the outer edges of the channels to form a bearing surface for the covers of the boxes. The gangway was designed to cut the boxes in two, so as to reduce the size of the covers, and also to



THE CONCRETE BLOCK FOUNDATIONS FOR THE PURIFIERS AT ROMFORD.

form a roller path for a travelling crane with extended arms to lift two covers at the same time.

Owing to labour troubles, there was a good deal of delay with the work, and the type of crane as described was discarded, and an overhead gantry, with traversing cranes, to lift and travel one cover at a time was erected in its stead.

Two cast-iron standards were fixed in each purifier, to give support to the gangway to which they were riveted, and the feet of the standards were securely anchored to the concrete bottom, to resist the lifting strain, caused by the pressure of the gas on the underside of the covers when in action.

Bearing Bars.

The bearers to support the lower tier of wood grids were 6 in. by 4 in. pitch pine, supported on brick blocking at 5 feet intervals. The upper tier of bearing bars was formed with two 9 in. by 3 in. deals, bolted together, with an 8 in. by ⅝ in. steel flitch plate between. The ½ inch space top and bottom was run full with hot pitch and tar to protect the steel flitch plate. These bearers were supported on concrete corbel blocks, built into the walls, and were strong enough to carry the wood grids and purifying material with no intermediate support between the walls.

Wood Grids.

The grids were formed with strips of 6 in. by 1 in. rough deal, kept at their proper spacing by being nailed to 1½ in. by 1 in. battens. These grids were supplied at a lower cost than the usual bevel-bar grids in hard-wood frames. They give a good surface for shovelling upon, afford a very free passage for the gas, and have no tendency to clog with the purifying material.

The pipe connections were arranged for a downward flow of gas through the boxes, and tubes and cocks were fitted so that gas tests on pressures may be taken at each layer of material.

Pipe Connections.

The whole of the socket joints of the 18-inch connections between the Weck valve and the boxes were made-up with tallow joints.

Rings of white yarn of suitable length were prepared by being soaked in a mixture of white lead, vegetable oil, and tallow, and then allowed to dry. The rings were caulked into the socket in the usual way, leaving a space about 2½ inches to the face of the socket. Another ring of prepared gaskin was then tucked in just level with the face of the socket, leaving an annular space about 2 inches deep. When caulking in the last gaskin, a gate was left at the top of the pipe, and through this a mixture of hot tallow and linseed oil was poured in sufficient to fill the annular space.

I became acquainted with this form of joint at Yarmouth many years ago, and have always used it when fixing heavy valves, &c., as, by the elasticity, it relieves the socket from strain; and with pipes of large diameter, it is much cheaper than the lead joint. Full particulars of this method of jointing may be found in the "Journal of Gas Lighting" for Nov. 18, 1879, p. 781, in a paper read before this Association by Mr. H. Townsend.

Details of Costs.

In adopting this form of construction for the purifiers, my object was to reduce the capital expenditure as much as possible, and I believe the details of the actual cost [see next page] will show this to have been successfully accomplished.

The prominent features of the work to which attention may be drawn are:

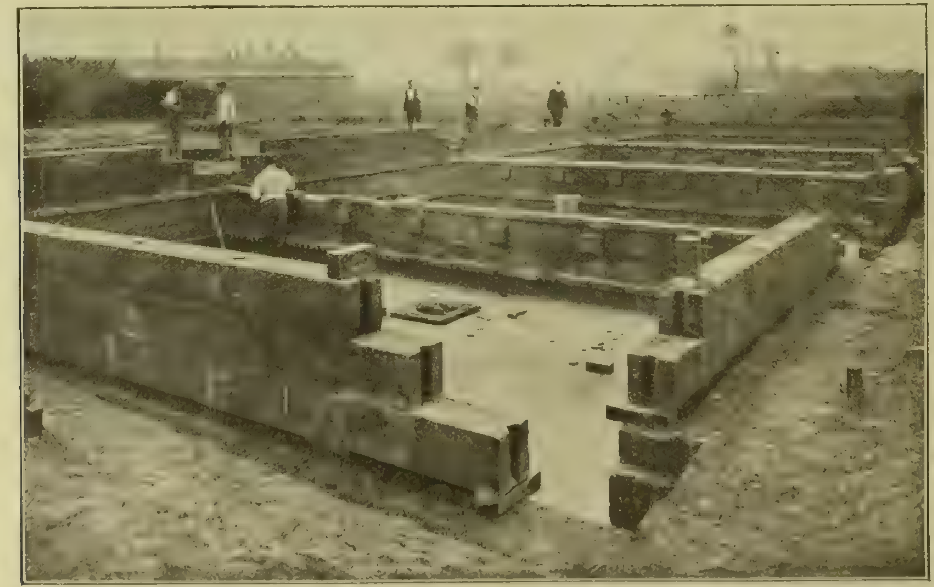
Use of concrete blocks, dispensing with all timber framing.

Coating with "Ironite" to render the concrete gas-tight.

The use of timber for bearing bars in place of steel, which rapidly deteriorates through contact with oxide of iron.

The type of wood grids adopted for use, and jointing all connections with the tallow joint.

As regards the working of the purifiers, they were put into operation on May 9, 1914, and ran continuously till Sept. 28, 1915,



THE CONCRETE BLOCK WALLS FOR THE PURIFIERS AT ROMFORD.

Cost of four concrete purifiers, each 30 *ft. by* 20 *ft. by* 5 *ft.* 6 *in. internal dimensions, with cast-iron coping plates on walls, channel steel gangway, eight steel covers, bearing bars, wood grids,* (5100 *feet super.*), *Weck valve,* 18*-inch pipe connections, also steel gantry and overhead traversing crane for lifting and travelling covers.*

				£	s.	d.
Earthwork excavation at 2s. 1d. per cubic yard				24	2	7
Labour putting in concrete bottom	£19	19	0			
Clinkers, breeze, sand, and cement (average 12s. 6d. per cubic yard)	67	12	6			
				87	11	6
Cement, breeze, and sand for block making				33	15	4
Labour for block making				12	17	3
Cement compo for laying blocks				3	10	10
Skilled labour, setting blocks				13	9	3
Rough labour, moving blocks				14	16	4
Labour, cement, and other material, used in concrete backing for walls, &c.				49	9	8
Cartages, July, August, and September				3	18	6
Ellis and Co., sample grid				0	3	8
Dowsing and Davis, wood grids to sample 5000 feet sup.				72	4	9
Jewson and Co., timber for bearing bars				22	12	7
Redpath, Brown, and Co., flitch plates and bolts				29	7	0
Labour on bearing bars				2	13	11
Iron supports for bearing bars				1	0	11
Gas Company's workmen, wages on purifiers				37	15	10
,, ,, ,, ,, on earthwork for pipe connections				13	3	2
,, ,, ,, chipping face of walls for rendering				3	15	0
Rendering tops of walls				3	13	6
Rendering face of wall above ground				8	1	11
"Ironite" for coating walls				27	16	3
Labour, applying "Ironite" inside purifiers				4	10	0
Earthwork for valve pit				1	1	7
Dowsing and Davis, building valve pit				10	0	8
Cleaning and painting covers, &c.				2	5	3
Testing purifiers with 20-inch air pressure				3	13	1
Total of Gas Company's work				£487	10	4
Contractors supplying and fixing cast-iron coping plates for walls, channel steel gangway, eight steel covers with fastenings, Weck's valve, and 18-inch pipe connections				1528	0	0
Steel gantry and overhead 3-ton travelling crane				239	0	0
				£2254	10	4

when I had one box opened so that I might see the condition of the purifying material.

The oxide with which the boxes were loaded, consisted of two-thirds new Irish bog ore and one-third old oxide, containing 38 per cent. of sulphur. This material, after being in use 507 days, and purifying 162 million cubic feet of gas, contained:

Top layer: Moisture 4·4 per cent. Bottom layer: Moisture 2·6 per cent.

Top layer: Sulphur 43·3 per cent. Bottom layer: Sulphur 38·8 per cent.

The order of working the purifiers had been changed about every ten or twelve days—*i.e.*, as soon as pressure began to rise; and the alteration in the order of working invariably resulted in a reduction of pressure within an hour.

As the work of emptying and recharging the boxes takes place at such long intervals of time, and the boxes stand less than 12 inches above ground, I can find no better method of doing the work than the use of the old-fashioned navvy barrow.

The cost of purification has been:

Six months ended June 30, 1913, 0·42d. per 1000 cubic feet gas sold
,, ,, Dec. 31, 1913, 0·40d. ,, ,, ,,
,, ,, June 30, 1914, 0·57d. ,, ,, ,,

With new purifier:

Six months ended Dec. 31, 1914, 0·17d. per 1000 cubic feet gas sold
,, ,, June 30, 1915, 0·08d. ,, ,, ,,

These figures include the cost of purifying carburetted water gas in a separate set of purifiers.

My principal object, however, was, by the use of different material and method of construction to that generally employed, to reduce the first cost of the plant.

DISCUSSION.

The President (Mr. W. Doig Gibb) said the members were obliged to the Hon. Secretary for having read Mr. Child's paper in his absence. There were one or two very interesting points in the paper. For instance, if any member had had experience of the tallow joint, his fellow-members would be pleased to have a little information from him regarding it.

Mr. P. P. Channon (Hayward's Heath) said that, while they fully appreciated Mr. Child's description of his purifiers, and admired his courage in adopting such a novel method of construction, it occurred to him (Mr. Channon) that, in using wooden bearers, with flitch plates between for carrying the grids, a good deal of useful space was being occupied in the purifiers. The purifiers were 5 ft. 6 in. deep. The bottom grids were carried on 6-inch by 4-inch pitch-pine bearers. He took it there must be 3 inches of space underneath the 6-inch bearers, so that there they had 9 inches of space occupied. Then the upper grids were carried by 9-inch deals; and the wooden grids were 6 inches deep. Therefore, they had in all a space of 2 ft. 3 in. in depth taken up by the grids and the bearers. Allowing 3 inches space underneath the bottom bearers, there was 2 ft. 6 in. of space occupied, or half the depth of the boxes. With an ordinary 5-foot box, bearers of 4-inch by 3-inch T, and the usual 2-inch wooden grids, there was only a matter of 13 inches taken up by the grids and space, leaving room for two 18-inch layers of oxide and a 5-inch clearance space. Whereas with Mr. Child's construction, if he used 18-inch layers of oxide, he would be close up to the next grids, and would not allow any space for circulation. His grids and bearers were really a loss so far as purifying capacity was concerned.

Mr. A. A. Johnston (Brentford) said he had had some little experience of ferro-concrete purifier construction. Before Mr. Child built his boxes, knowing that he (Mr. Johnston) had had some experience with these concrete blocks, he came and asked his opinion as to whether he thought blocks would make satisfactory purifiers. Experience up to that point had led him to the conclusion that the blocks themselves were too porous for gas-resisting purposes, especially if there was any great pressure put upon them. However, Mr. Child had the courage of his convictions and went on with the job; and he was glad to know he had brought it to a satisfactory conclusion. Since that time, he (Mr. Johnston) had had two 40-feet boxes constructed of ferro-concrete, using shuttering in the ordinary way. They had considerable difficulty at first owing to the fact that the concrete was put in in layers from time to time; and, through the unequal drying of the concrete, joints were formed between the new layers and the layers of yesterday. Ultimately, however, this was overcome; and the boxes were made perfectly tight. Now he was glad to say they were quite satisfactory. The object of concrete construction was not only to save cost, but to utilize material that they themselves produced. The cost of construction in Mr. Child's case worked out to about 3s. 5d. per cube foot; at the Southall works the cost of ferro-concrete construction, for the 40-feet boxes there, worked out to about 1s. 7d. But a great deal of the lower cost was due to the larger size. He had also put in some iron boxes on the ground, as Mr. Child had his block boxes, at a cost of 2s. per cube foot. He just gave these figures as some indication of the difference in the cost of iron construction in the ordinary way and that of concrete construction. He believed there was a big future for ferro-concrete construction. He had been using blocks for all sorts of purposes for some years; and he also thought there was a big future in gas-works for ferro-concrete construction. As to the point raised by one gentleman with regard to bearer-bars, perhaps Mr. Child did not use his oxide in layers. It was common practice in these days to fill the boxes completely from top to bottom. This was the system he himself adopted; and the size of the bearer-bars was not in this case a very great matter.

Mr. H. C. Head (Winchester): As I read the paper, it was fairly evident the oxide was used in layers.

Mr. A. E. Broadberry (Tottenham) said he was extremely sorry Mr. Child was not there, so that he could have further enlightened them with regard to many of the interesting points that occurred to one's mind in hearing the paper read. It was very useful to them that one of their members had been bold enough to make these experiments, and be willing to place the information before them—not only as a record of work done, but as a guide to follow if found good, and to avoid if not successful. Mr. Child had placed the matter before them in a very candid way. It so happened that at the present time, he (Mr. Broadberry) was particularly interested in concrete purifiers—he would not say exactly of the type that Mr. Child had adopted, because frankly he was not struck with them as being the most ideal. Mr. Child had not used reinforced concrete; he dug a hole for the boxes, so as to get the support of the earth for the walls. He used Winget blocks, which most of them knew fairly well; but they were not to his mind a good material for constructing purifiers. Mr. Child put a 9-inch concrete backing behind the Winget blocks to make a gas-tight job; but having the whole thing buried in the ground, if leakage occurred, he could only get at one side of the work, and could only get at that one side at a time when the purifier was open. Thus he would have very little opportunity of tracing where leakage was taking place. The lines upon which he (Mr. Broadberry) was working at the present time at Tottenham were very different. He had taken advantage of an opportunity of going to see the work Mr. Johnston had done at Brentford. He learned a great deal from the work; and the informaiton had been very serviceable indeed to him. Mr. Johnston had also most kindly allowed him to have copies of his drawings; and these had been exceedingly useful in the work they were at present designing. Mr. Fisher, his assistant, was present. He had had direct charge of the designing of the purifiers; and he would probably be able to tell the members more about the details of the work. If success attended it, it would be partly due to such experimenters as Mr. Child and particularly Mr. Johnston. Their idea at Tottenham was to construct overhead purifiers, supported on columns. It seemed to him that they would not have a great deal of trouble in properly constructing a gas-tight ferro-concrete floor and boxes. They were also proposing to adopt "Ironite," as a means of making the work both water-proof and gas-proof. "Ironite" was a substance they had experimented with at Tottenham for a good many years; and they had found it successful for a great many purposes. It was, in his opinion, an ideal substance for water-proofing and gas-proofing. If they erected their ferro-concrete purifiers overhead, with the walls exposed on the outside, they would be in a far happier position should there be leakage, because they would be able to get not only at the inside but at the outside of the boxes in every part; and, further, they would be able to get at the outside under working conditions, so that, if there was leakage, it would be at once detected. Its exact location could be found, and proper steps taken to rectify the fault. If there were some other members of the Association who had any information on the subject of ferro-concrete purifiers, personally he would be very grateful to them for any hints. To a large extent in this matter, they were searching in the dark for any information regarding the subject that might be available. After they had carried out the work at Tottenham, they would be pleased to place the results before the members of this or some other Association in connection with the industry.

The PRESIDENT: We shall look forward to the paper with much pleasure. Mr. Broadberry mentioned that Mr. Fisher was present, and would probably supply further information.

Mr. FISHER said that he accompanied Mr. Broadberry to Brentford to see the purifiers there. It seemed to him that from a constructional point of view reinforced concrete was almost an ideal material for purifiers, provided it could be got gas-tight, and be maintained gas-tight. He had searched through Mr. Child's paper to see whether there was any remark in regard to the gas-tightness of the vessels. He did not say that he subjected his vessels to any severe test; and he did not mention anything to indicate that he found them gas-tight. But he did say they were satisfactory; and from this, he supposed, they might take it they were gas-tight. As Mr. Broadberry had indicated, the work at Tottenham was only just getting to the end of the designing stage. The work had not been let yet, nor had anything been done on it. There was no difficulty as to getting guarantees. They found contractors willing to guarantee water-tight tanks; and the "Ironite" people were quite prepared to guarantee that the purifiers should be gas-tight if they were water-tight, and received two or three coatings of "Ironite." This reduced the experiment to very narrow limits. They would have a water-tight vessel and a gas-tight one. Could they keep it so? Could they keep the purifiers free from temperature cracks? This was a matter of designing and reinforcement. They might—he hoped they would—get a thoroughly satisfactory job, and something that was superior to cast iron. They would have a vessel 50 ft. by 40 ft., free of anything in the nature of brackets, &c.; and they would have five of these, and only five columns under them. This would be due to the monolithic character of the concrete. The floor slab of the vessel was the compression member of the reinforced concrete beams; the boxes were self-supporting, as they were monolithic. It was not like putting concrete on to iron columns, &c. They were obliged to Mr. Johnston for his hint as to continuous concreting, so as to avoid jointing.

The PRESIDENT said he thought it would be difficult to persuade many of the members that, under ordinary circumstances, the building-up of a structure of concrete blocks was preferable to a reinforced concrete structure, which could be made in one piece without the necessity for a great many joints. This was really only common sense. They sometimes forgot, too, that where a box had only to be emptied once in 507 days, it did not pay to put down £700 or £800 worth of machinery to produce a low decimal point cost per ton of oxide handled. Machinery must be worked to pay; it did not pay standing idle.

In proposing a vote of thanks to the authors of the papers, Mr. SAMUEL GLOVER (St. Helens) made some remarks on Mr. Child's paper. These will be found towards the end of our report of the ordinary proceedings [see p. 636].

Brandenburg Association of Gas, Electricity, and Water Engineers.

The thirty-seventh annual meeting of this important German District Association is to be held at the Association of German Engineers in Berlin next Saturday. The proceedings will include an informal discussion, opened by Herr Lempelius, the head of the German Central Gas Publicity Bureau, on War Conditions as affecting Gas, Electricity, and Water Works. The discussion will fall under three heads—viz., (1) Coal Supply, (2) Labour, and (3) the Embargo on Metal. On the following morning members will visit the Museum of the Lighting, Heating, Water, and Allied Industries in the Wilmersdorfer Strasse at Charlottenburg. This Museum has lately been extended, and many fresh interesting exhibits added. On Monday of next week, the members will pay a visit of inspection to the Debenzolizing Plant of the Berlin Corporation gas undertaking at the Gitschinerstrasse works. The Chairman of the Association is Herr Kümmel, of Charlottenburg.

* * *

At to-night's meeting of the Institution of Petroleum Technologists—Society of Arts rooms, eight o'clock—after a valedictory address by the President (Sir Boverton Redwood, Bart., D.Sc.), a paper will be read by Dr. J. A. Leo Henderson, upon the "Natural Gas Industry: Its Progress and Importance."

A recent advance of 400 per cent. by German colour manufacturers in the prices of coal-tar colours in neutral countries, is, it is reported, to be followed by another increase of 100 per cent. A desire is manifested to cancel all existing contracts; this being prompted by the fact that quite a large number of dyestuffs can no longer be made by the German firms. There is a great shortage of the requisite raw materials; and those colours which can be produced cost five or six times as much to manufacture as before the war.

COAL CARBONIZATION AND BYE-PRODUCTS.

Middlesbrough Coke-Oven Gas Supply.

The happy position of Middlesbrough in regard to its gas supply, and the economical advantages of bye-product coke-ovens, were freely commented upon at a meeting of the Cleveland Society of Engineers, held at Middlesbrough on Monday of last week. The references were contained in, and prompted by, a lecture on "Fuel Economy from a National Standpoint," by Professor William A. Bone (a native of Cleveland), who pointed to the great waste in bye-products by the old-fashioned bee-hive oven method of carbonization, and suggested that the Government should be pressed to give a reasonable time-limit beyond which no bee-hive installation should be allowed to remain in operation.

Dr. J. E. STEAD referred to the fact that Middlesbrough was in the position to-day that it received no gas direct from coal, but from the bye-product coke-ovens of Messrs. Samuelson and Co. This, he said, was an enormous economy; and he trusted that the example would be followed by many other towns.

Mr. BERRY mentioned a visit to Westphalia twenty years ago, when, he said, coke-ovens were quite as common as they were in England at the present day, and another visit ten years later, "when there was only one bee-hive left, and that was to look at." These coke-ovens, added Mr. Berry, had without doubt stood the Germans in good stead during the present conflict, by reason of the great output of bye-products; and they would continue to do so. England would have been decidedly better off had more attention been long ago paid here to this matter.

Professor BONE, referring to the last normal year of 1913, said that out of the 20 million tons of coal carbonized in this country in that year for hard metallurgical coke, no fewer than 6·5 million tons were treated in bee-hive ovens, involving a dead-loss in the value of bye-products of something like £2,500,000. In face of the fact that all bee-hive ovens had long been abolished in Germany, their continuance in this country was a grave reflection on our industrial economies. Another question which should receive immediate attention was the organization of cheap supplies of gas for manufacturing purposes, which was playing a great part in the promotion of more scientific means of applying and controlling industrial heating operations. The larger users of gaseous fuel would doubtless continue to find it cheaper and better to generate producer gas by the complete gasification of coal and coke on their own premises, than to purchase gas from any public company. But there remained a very large number of industrial consumers whose individual needs of gas were not large enough to warrant the installation of a separate gas-making plant but whose requirements constituted in the aggregate a very large and important demand, which could only be met economically by a public supply company. Some of the large town gas-works situated in industrial areas were taking up the matter with great energy and success. An enlightened policy was apparent; and this had led to the considerable use of coal gas in some of the Sheffield steel-works, chiefly for the hardening, tempering, and annealing of special steels (including tool steels), and for file forging. These were all operations in which accurate temperature control was of vital importance. The rapid development of the bye-product coking-oven, followed immediately by that of the large gas-engine, for dealing with washed blast-furnace gas, had only emphasized the advantages referred to. Proceeding, Professor Bone advocated greater scientific study into the real nature of the complex compounds contained in the coal substance, in order that we should know more of its combustion and distillation.

SCOTTISH JUNIORS AT KILMARNOCK.

Members of the Scottish Junior Gas Association (Western District) visited the Kilmarnock Corporation Gas-Works on Saturday last. A very profitable, as well as enjoyable, afternoon was spent inspecting the new Dempster vertical retorts, and the tar dehydrating and benzol recovery plant. One item of special interest was the apparatus for retinning electrically the gas-stove pans which come back from consumers in a dirty state.

It was explained that the Dempster system of vertical retorts was decided upon after the coal strike about four years ago; and it was selected after due consideration of the position of Kilmarnock, situated as it is on the Ayrshire coalfield, where both low and high grade coal is extensively mined, and where in an emergency very low-grade coal might require to be used. The tar dehydrating plant was installed owing to the fall in the price obtainable for crude tar; and the benzol recovery apparatus was added to complete the equipment. The tar dehydrating plant was intended to prepare the tar to suit the requirements of the Road Board; and as the Board only required tar at certain periods of the year, it was found necessary to instal a large storage tank for crude tar. Since the outbreak of war, however, the Road Board has been economizing; and there is now so little demand for tar that they are forced to sell their current make at a loss.

After going over the works, the party were entertained in the Town Hall. Provost Smith, in welcoming the visitors, said that they were honoured by the visit; and he was glad to think that the Kilmarnock Gas-Works were deemed worthy of a visit. He thought it was good for the members of such an Association to visit gas-works and enjoy a pleasant and profitable outing; and Kilmarnock should be interesting from the fact that the gas-works were started there almost a hundred years ago. At that time, records show that they paid a Gas Manager £100 per annum, with free house, &c.; but in course of time this sum was reduced to £50 per annum. Then the undertaking was in the hands of a Company, from whom it was taken over by the Corporation 45 years ago. The original gas-works were built on a hill, but the present site of 16 acres were purchased about fifteen years ago, and the new gas-works were opened in 1904. The vertical retorts were not yet out of the makers' hands, as the haulage system was still incomplete. When the Corporation took over the works, the make was some 40 millions, and the price 5s. 10d. per 1000 cubic feet. Now the make is 220 millions, and the price 2s. 8d., which is a war price, and 5d. in excess of what it was. Mr. Fulton suitably replied.

The rest of the evening was spent in harmony. Mr. William Bennett's paper on "Some Notes on Purification" [*ante*, p. 419] was not discussed.

COAL TAR RESEARCH.

Writing in its issue of the 1st inst., "Gas Age" [New York] has the following article:

As we go to press, news comes from Baltimore of the establishment of a laboratory for chemical research in the development of industries which depend for their crude material upon coal tar. This involves the subjects of dyes, drugs, explosives, flavours, wood preservatives, and similar material used in the chemical industry. Since there are probably two thousand of these products, it is quite evident the laboratory will have a large field for investigation. The laboratory is located at Johns Hopkins University, Baltimore; and the very important feature of this investigation is that it is backed by some of our largest gas companies.

The opportunity presented in such an investigation of devising methods and products which can be manufactured from the bye-products of any gas-works is a very important consideration. If the chemists engaged in this work are brought to realize the importance of devising means by which the average gas plant can prepare the crude material without much expense, and make it available for subsequent chemical manipulation, they will be doing a great service to the gas industry; for it is not reasonable to suppose that the ordinary gas tar, with its miscellaneous admixtures, is in a proper condition to be immediately handled by chemical works. The field which this opens up for the utilization of gas tar will not only result in a better price for it, but also in providing the industries of this country with chemicals, many of which have heretofore been imported at great expense.

The gas companies who are backing this enterprise are to be congratulated upon their public spiritedness, as well as upon their foresight in building-up a market for a product which is so little valued as to be used even for firing boilers and laying dust upon macadam roads. The possibilities in the working-up of these tar products can be realized when it is remembered that a large number of factories have been started since the European trouble, and are to-day successfully making the dyes and other chemicals for which we formerly depended upon foreign sources.

As time passes, it becomes more and more evident that the industries of this country must become more or less independent of the rest of the world; and we would suggest to our readers, if they have an opportunity to help along any movement of this kind, that they give it their hearty support.

While upon this subject we might suggest to those manufacturers who are devoting their entire attention to the making of war material, that this war will not last always, and when there are no more war contracts they will have to do something with their plant and employees. It is not too early to consider this exigency; and those who have in the past supplied gas companies with material should take more than ordinary interest in the efforts which tend toward increasing consumption. It is largely through extensions that the products of their works will be needed; and these extensions are naturally forced by increased consumption.

There is also the upward trend of prices to be considered, and means should be devised by which these can be met by economies in manufacture and efficiency in operation. The European war has introduced problems which the farsighted will consider meeting before the need arises.

At the meeting of the "Directors" of the American Gas Institute, held on the 10th ult., the following resolution dealing with the above matter was adopted: "The Directors of the American Gas Institute desire it to go on record as approving the action recently taken by Johns Hopkins University in establishing a course in coal gas bye-product recovery, and the establishment of a suitable experimental plant in connection with this work. The Directors also take this occasion to express their appreciation of the work being done by other Colleges and Universities—such as Michigan, Wisconsin, and Illinois—where courses have been established, and suitable laboratories equipped, for the study of gas engineering. It is the hope of the Directors that other scientific institutions will start similar work; and the Directors assure them of the sincere support and interest of the American Gas Institute."

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Tar Prices.

Sir,—I have for some weeks past noted the serious decrease in the price of tar weekly stated in the "Journal."

It appears to me that the price of tar ought to be of considerably greater value; and that it is in some manner being depressed by the tar distillers.

In justification of this I would point out that I recently wrote our tar distillers, offering to take back from them some portion of our pitch for the purpose of carbonizing it, and thus helping to relieve the situation of the accumulation of pitch at their works, which they keep arguing is the cause of the serious decline in the value of tar.

The result of my correspondence has been that while they assure me they are losing money in paying 20s. 6d. for our tar, they yet inform me that it would not pay them to sell pitch on the basis of Mr. Young's circular, as they would be losers by it; but they would be willing to send me a truck-load of pitch at 21s. per ton net my works.

This certainly gives one the feeling that they are making profit out of their arguments as to accumulation of pitch, and that they do not desire gas managers to ease the situation, because surely, if as they state, the least price they can take for pitch is 21s. per ton, the value of tar is considerably higher than that quoted by the "Journal" this week [March 14].

N. W.

March 15, 1916.

Mortgage Bonds.

Sir,—With regard to the reply by "Accountant" in the last "Journal," I am obliged for the information therein. Do I understand the endorsement referred to should be embossed with a sixpenny stamp irrespective of the amount of the bond, or 6d. per cent. as a "substituted" security?

Another point upon which I am not quite clear is the proviso "that it is executed during the currency of the security." I assume "currency" means any continuity of the same instrument.

Will "Accountant" do me the favour of clearing up these points?

Enquirer.

March 16, 1916.

The Terms of Mr. Leech's Appointment at Leeds.

Sir,—I notice in your issue of the 7th inst., a paragraph referring to the discussion which took place at the last meeting of the Leeds City Council, in which it is wrongly stated that I am barred by my agreement from giving expert advice.

It was not until some time after my agreement with the Leeds Corporation was signed that my Committee, knowing that considerable effort would be required on my part to place the Department on a proper footing, suggested that I should not undertake any private work until the reorganization had been completed. The time fixed was for a period of two years from the date of my appointment.

I shall be glad if you will kindly correct the statement referred to in your next issue.

W. B. Leech, General Manager,
Leeds Corporation Gas Department.

Market Hall, Leeds, March 11, 1916.

[The statement in the "Journal" which is referred to by Mr. Leech, is not literally reproduced in the above letter. In the remark attributed to Mr. Alderman W. Penrose-Green the words "by the agreement" did not appear. We are sorry if the "Journal" paragraph represented that gentleman as saying something which he did not say, and welcome Mr. Leech's explanation, which will remove any possibility of misunderstanding.—Ed. J.G.L.]

Naphthalene Troubles at Salford.

Sir,—In your report of my remarks on Mr. Simmonds's paper, on "Naphthalene," you state that in 1914 we had only 172 complaints—quite a phenomenal year—and in 1915 we reduced them to 159. These figures should read "daily" complaints. Will you please correct the same?

The deposit we found left after the elimination of naphthalene by various solvents caused us more trouble than the stoppages due to naphthalene. It contained at least 7 per cent. of prussian blue; a great percentage of oxide of iron; and a condensation in the nature of oil. My object in offering any remarks on the subject was to ascertain if any of the members had similar experience.

R. H. Garlick, Outdoor Superintendent,
Salford Corporation Gas Department.

Salford, March 14, 1916.

Brentwood Gas Company.—The operations of the Company during the year ended Dec. 31 last resulted in a profit of £4474. After payment of dividends (less income-tax) of 8 per cent. on the original stock and £5 12s. per cent. on the additional stock, there will remain a balance of £924 to be carried forward.

Lichfield Gas Company.—Commenting upon the accounts at the annual meeting of the Lichfield Gas Company, the Chairman (Alderman H. M. Morgan) said coal had cost £2500 more than in the preceding year, which was an enormous increase for a small undertaking. Rates and taxes also were £884 more; and the extra charge of 6d. per 1000 cubic feet for gas had nothing like covered this additional expenditure. Owing to the shortage of labour and the inefficiency of that available, it had been decided to instal machinery in the retort-house. Sixteen out of 26 employees had joined the Colours, and the Manager (Mr. F. Key) and those of the staff who remained had had a very arduous twelve months.

REGISTER OF PATENTS.

Recording Percentage Volumes of Constituent Gases.

Crosweller, W. W., of Crumpsall, Manchester.

No. 5041; April 1, 1915.

This invention relates to an instrument which is particularly applicable as a carbon dioxide (CO_2) recorder. The patentee's object has been to design an effective instrument with a minimum of component parts as compared with known instruments for the purpose, thus minimizing the liability to get out of order. The instrument is operated by water head, and a gas-burette is so arranged in relation to the power vessel and a syphon used for draining off water from the power vessel that the burette will always hold a quantity of water which will become stagnant and become charged with any gas which is soluble in water. The power vessel is in direct communication with the gas-burette, without any intervening air-lock, or any controlling mechanism, governing the communication. The exact adjusting of the volume of gas to be measured and the ultimate drainage of the gas sample is effected by a single tube sealed directly by the rising of the water in the power vessel. The three vessels needed therefore are: The power vessel, the gas-burette, and the absorption vessel, apart from a float vessel and float and the usual pen-gear, clockwork drum, and recording chart.

Incandescent Gas-Burners.

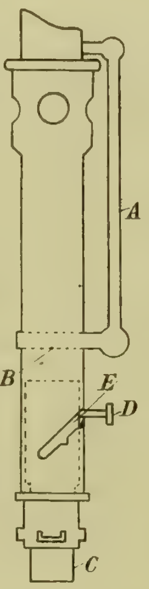
Sparks, E., of Harringay, N.

No. 2823; Feb. 22, 1915.

To increase the velocity of the mixture of gas and air at the point of delivery in atmospheric gas-burners (of the type in which additional gas is supplied through a bye-pass tube to the burner between the mixing chamber and the burner-head at a distance from the nipple), the patentee proposes to introduce an additional gas supply in the form of a bye-pass, capable of being increased in volume, and which he calls "the reinforced gas supply."

The reinforced gas supply enters the main burner-tube at a point nearer to the delivery nozzle than that at which the original supply enters, and is connected to the main supply through a separate tube at a distance from the nipple. It is controlled by a cock and mixed with the original mixture before being delivered at the nozzle of the burner, and is used as a pilot flame when the main supply is closed—being increased through the separate tube when the main supply is opened.

In the illustration the reinforced gas supply tube A is outside the main burner-supply tube; the outlet of the reinforced supply into the main supply (shown at B) acting as a bye-pass when the burner is extinguished and increased before being delivered at the burner nozzle C, when the main supply is opened. The reinforced supply will be reduced when the main supply is closed-off, and be left burning as a pilot flame at B. The nozzle is shown as an adjustable tube which can be raised or lowered by the pin D; being movable within the slot E.



Sparks' Incandescent Gas-Burner.

Retort Discharging Machines.

Simmonds Engineering Company and Simmonds, J. J., of Iola, Kansas, U.S.A.

No. 3147; Feb. 26, 1915. Convention date, March 9, 1914.

This invention relates to apparatus for "removing simultaneously from a plurality of furnace retorts the residue remaining after heat treatment of ore therein," by means of a movable main or master carriage and a plurality of plungers actuated by the carriage and adapted to enter the retorts of a furnace—means being provided in the plungers for discharging the retorts simultaneously with the advance of the plungers.

In the preferred embodiment of the invention as disclosed in the specification each clearing element is of the kind which has already been proposed in connection with apparatus for clearing a single gas-retort, and comprises an endless chain movable over sprocket wheels or idlers and adapted to be advanced and retracted—the chain carrying scrapers which progressively remove the residue from the retort simultaneously with the advance of the clearing element into the retort.

Furnaces.

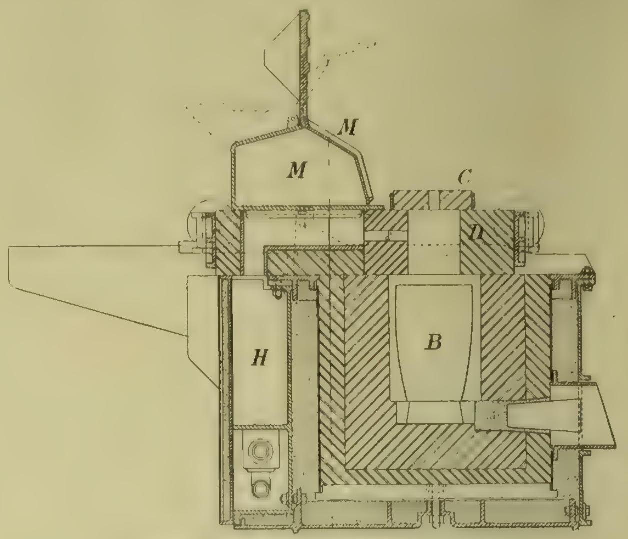
Yates, H. James, of Four Oaks, near Birmingham, and Brayshaw, S. N. & E. R., of Hulme, Manchester.

No. 7966; May 29, 1915.

This invention relates to crucible furnaces (with movable covers) for melting metals or alloys. It consists in the particular disposition of the parts of the furnace—comprising a cover fitted with wheels or runners traversing rails affixed to the furnace structure (a flue being provided in the cover above the level of the crucible or pot); a regenerative chamber behind the furnace, to heat the fuel air and gas, with which the flue communicates; and with or without a pre-heating chamber mounted on the movable cover, the bottom of which is heated from the flue.

A longitudinal section of the furnace is given, with the pre-heating chamber.

The furnace to receive the crucible B is built of fire resisting blocks with an aperture at the top through which the crucible can be introduced or removed. The cover D (also of fire-resisting material) is formed with an opening to give access to the crucible and with a flue to carry away the products of combustion and the waste heated gases at a point above the top of the crucible, so that these pass over it. The aperture is closed by a lid C, which may readily be pushed to one side by hand. A regenerative chamber H is formed at the back of the furnace through which pipes for gas and air pass to heat the gas and air before passing into the burner. The flue in the cover D discharges downwards into the chamber H—a baffle-plate being placed therein to deflect the heated gases downwards and to the outlet, which is controlled by a damper. A pre-heating chamber M may be mounted on the furnace to receive and pre-heat the ingots of metal before being placed in the crucible. The bottom of the chamber M may form part of, or be in close proximity to, the top of the flue in the cover D, so that it readily receives heat from it. It is provided with a lid, preferably hinged and counter-balanced by a weighted lever, so arranged that the leverage of the weight will vary as the lid is opened or closed, and the lid will be retained in either the open or closed position as desired.



Yates and Brayshaw's Crucible Furnace.

The burner employed may be constructed as described in patents No. 11,117 of 1910 or No. 5931 of 1911, or it may be of any other form for injecting a mixture of gas and air into the furnace.

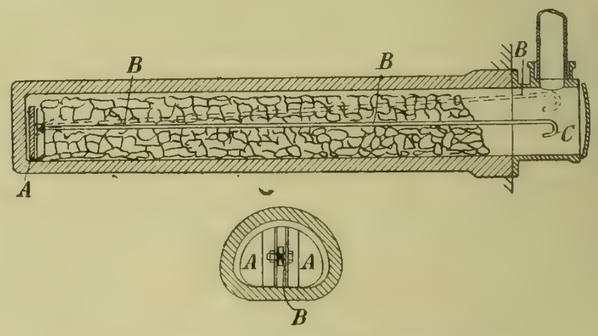
Discharging Retorts.

Gibbons Bros., Limited, of Lower Gornal, Staffs., and Masters, E., of Palace Chambers, Westminster.

No. 10,058; July 10, 1915.

This invention has reference to improved means for discharging retorts, and particularly horizontal retorts open only at one end.

Heretofore (the patentees remark) various means have been employed for discharging these retorts. One appliance comprises an iron drawplate which, when placed in the retort, stands up vertically and is pushed up to the back end before charging—the plate being furnished with a draw rod which lies on the bottom of the retort and extends into the mouthpiece at the front end, where it is hooked or is otherwise arranged for connecting to a pulling device so as to withdraw the plate, with the charge in front of it, out of the retort. Heretofore the rod has been made of flat section and laid on the bottom of the retort, where "it has become intensely hot and therefore has soon deteriorated and had to be renewed." According to the present invention, the rod is of round or other solid section, and at one end is jointed or otherwise connected to about the centre of the drawplate, so that it will lie in about the centre of the charge in the retort. Thus it is claimed that the bar will last very much longer in use than the usual flat section draw-bar.



Gibbons and Masters' Retort Discharging Device.

A longitudinal and cross section are given of a horizontal retort with the invention applied to it—showing the charge in the retort with the draw-rod in the middle of the charge. The drawplate is made of about the same shape but smaller than the cross section of the interior of the retort. It has fixed to its front face (and at about the centre of the retort) the draw-rod B, of round section, hooked at its front end C and made somewhat shorter than the internal length of the retort and mouthpiece. It will not thus be subjected to the full heat of the retort until the charge is practically ready to be withdrawn. When charging the retort the bar can be raised "so as to form but a very slight obstruction to the throwing in of the first part of the charge at the back of the retort," and then moved down again to its proper central position until the charging is completed.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bill reported, with amendments: Burnley Corporation Water.

The Imperial Continental Gas Association Bill has been referred to a Committee, to meet to-day.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bill read a second time and committed: Tynemouth Corporation.

Bill considered: Aberdeen Corporation Water.

The petitions presented against the Northwich Gas and Plymouth and Stonehouse Gas Bills have been withdrawn.

The following Bills have been referred to a Select Committee, consisting of Sir W. Howell Davies (Chairman), Mr. G. W. Currie, Mr. Hinds, and Mr. Herbert Whiteley—to meet to-morrow: Beighton and District Gas, Folkestone Gas, South Metropolitan Gas, Uxbridge Gas. The Plymouth and Stonehouse Gas Bill was included in this group, but, being unopposed, has since been removed.

The Northwich Gas Bill has been referred to the Committee on Unopposed Bills.

Electric Lighting of Trains.

Mr. ROWLANDS asked the President of the Board of Trade, on Tuesday last week, whether he could state to what extent the substitution of electric lighting for gas lighting had taken place on the railways, and if the change was being made at a satisfactory rate? If not, would the Board of Trade obtain powers to enforce its speedy adoption?

Mr. RUNCIMAN replied that the railway companies generally had made considerable progress in effecting the change, but that the work had necessarily been interfered with owing to shortage of labour and material and other conditions caused by the war.

Aniline Dyes and Oils Imported.

Sir RICHARD COOPER asked the President of the Board of Trade what were the total imports and exports of aniline dyes and oils in Switzerland, Holland, Sweden, and the United Kingdom during the years 1913 and 1915?

Mr. RUNCIMAN stated that no particulars were available for the Netherlands, and no particulars were available for 1915 for any of the countries specified. In 1913, the quantities imported were: 698 tons into Switzerland, 960 tons into Sweden, and 14,151 tons into the United Kingdom. The exports were 7035 tons from Switzerland; *nil* from Sweden; and 2434 tons from the United Kingdom.

LEGAL INTELLIGENCE.

WORKMEN'S COMPENSATION ACTS.

Last Tuesday, the Master of the Rolls, Lord Justice Phillimore, and Mr. Justice Sargant heard an appeal by the respondents in the case of Paulizky *v.* Wandsworth, Wimbledon, and Epsom Gas Company from the award of the County Court Judge sitting at Wandsworth.

Mr. SHAKESPEARE said the County Court Judge, on an application by the workman to review an award of 1d. a week, refused to accede to the employers' request to terminate the payment altogether, on the ground that he had no jurisdiction to do so. The same point had been before the Court of Appeal on several occasions; and it had been held that the County Court Judges had jurisdiction. The Judge found that the workman was not entitled to any increase, as the incapacity was found not to be attributable to the accident. The first award of 1d. per week was made on April 1, 1913, when further payment of compensation ceased; and on May 26, 1915, the workman applied to review the award, and asked for an increase of the weekly payment—alleging that he had not been able to work since the award was made in April, 1913. The Judge found that since the hearing in April applicant had not been incapacitated for work; and that his mental condition was not the result of, or contributed to by, the accident. The Company then asked that the liability to pay 1d. per week should be terminated. Employers, it was contended, had a right to have the question of compensation settled once and for all.

Their LORDSHIPS remitted the case to the County Court Judge to arrive at a decision—expressing the opinion that he had jurisdiction to entertain, and determine, an application to put an end to any further payment.

East Cowes Gas Company.—At the annual meeting of this Company, held at the London office yesterday, it was reported that the sale of gas in 1915, compared with the previous year, increased by 6,725,600 cubic feet, or 25·5 per cent.; and the revenue from residuals by £521. Owing to the phenomenal increase in the cost of coal purchased during the year, the Directors state that they were compelled to raise the price of gas by 5d. per 1000 cubic feet, as from April 1. The additional receipts due to this increased price and to the important increase in the volume of the Company's business only sufficed, however, to meet the extra charges for coal and wages and the enhanced cost of the maintenance and renewal of the works and plant. After charging to the profit and loss account £260 for interest, income-tax, &c., a sum of £2231 remained, and allowed a dividend for the year of 6½ per cent.—absorbing £780, and leaving a balance of £1450 to be carried forward.

MISCELLANEOUS NEWS.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The report of the Directors for the half year ended Dec. 31, which will be submitted at the meeting in Dublin on the 30th inst., states that, after debiting the revenue account with the sums of £4500 and £2174, being capital adjustments in connection with the sale of gasholder columns and the sale of further wet meters, and making a contribution of £1000 to the officers' superannuation fund, the profit for the half year amounts to £45,239. After providing for interest on debenture stock and temporary loans, there remains a balance of £36,847, to which must be added the sum of £10,663, the balance brought from the last account, and a credit from income-tax account amounting to £4243, making a total of £51,753. The Directors recommend the declaration of the maximum statutory dividend on the consolidated ordinary stock of the Company, at the rate of £5 2s. 6d. per cent. per annum, less income-tax. This will absorb a sum of £39,766, after which a balance of £11,987 will remain to be carried to the next account. In view of the abnormal increases over pre-War times in the cost of coal and freight, the Directors are again very gratified with the results of the half-year's working.

In addition to the two existing vacancies caused by the lamented death of Mr. Richard S. Tresilian, J.P., and the resignation of Alderman Cotton, M.P., two of the Directors (Mr. Francis J. Dickens and Mr. William H. Davies) retire by rotation, and, being eligible, offer themselves for re-election. Mr. Francis M'Bride, one of the Auditors, will go out of office by rotation, and, being eligible, offers himself for re-election.

In the revenue account, the receipts were: Sales of gas (after deducting discounts), £116,204; meter and stove rents, £12,790; residual products, £44,175; and miscellaneous receipts, £3002. The items on the expenditure side were: Manufacture, £90,812; distribution, £21,696; public lamps, £223; rent, rates, and taxes, £5967; management, £7966; and miscellaneous and special charges, £4268. This left a balance of £45,239 to be carried to profit and loss account. The quantity of gas made was 816,301,000 cubic feet, including 309,144,000 cubic feet of carburetted water gas. The quantities sold were: Public lighting, 41,798,000 cubic feet; private lights per meter, 651,880,000 cubic feet; total sold, 693,678,000 cubic feet. The quantity used on the works, &c., was 12,455,000 feet; the total quantity accounted for, 706,133,000 feet; and the quantity not accounted for, 110,168,000 feet. The number of public lights is given at 6258.

MELBOURNE GAS COMPANY.

The Ordinary General Meeting of the Metropolitan of Melbourne Gas Company was held on Jan. 28—Mr. JOHN GRICE (the Chairman) presiding.

The CHAIRMAN, in moving the adoption of the report and balance-sheet, said that during the past twelve months the Company had sold 3012 million cubic feet of gas, compared with 2794 millions for 1914—an increase of 7·8 per cent. The year 1914 indicated an increase of 7·89 per cent. over 1913; so that the past two years showed a steady and consistent rate of progress, though it was not so great as that prior to the difficult period through which they were now passing. On the whole, the Directors thought the shareholders must be more than satisfied that the returns had been so well maintained. On Dec. 31 last, the number of ordinary meters fixed was 119,079, an increase of 4476 for the year, and the number of slots, 26,613, an increase of 711. As the increase in meters fixed was equivalent only to 3·69 per cent., while the increase in consumption was 7·8 per cent., it was probable that the individual consumer was turning more to the use of gas in place of other forms of fuel for domestic purposes. The number of stoves sold during the year was 9189, compared with 11,290 in 1914—the result, no doubt, of fewer houses being erected. The number of stoves on hire had decreased by 1287. Consequently, at the end of last year the Company had 7902 more stoves in use than twelve months earlier. The stoves in use by slot consumers, who now numbered 26,407, increased in 1915 by 2089. Nearly 87 per cent. of the slot consumers were now supplied with cooking-stoves. The use of gas for cooking purposes was increasing in large institutions. In the last three years they had sold no fewer than 34,884 stoves; but the number on rental had decreased by 6432. Of bath heaters they had in the last twelve months disposed of 1237, an increase of 253 over 1914, and of gas-fires 2882 sales had been effected, representing an increase of 713 over the preceding year. That the adoption of gas consuming appliances by the individual consumer was yearly increasing was proved by the fact that the number of gas-fires sold in 1911 was 756, while for 1915, it was 2882—about four times as many. At no other time had coal gas as a fuel for industrial purposes had a greater impetus than now. In the melting of metals, gas, when applied under air pressure, should strongly appeal to the local brass founders. By the introduction of gas-fired furnaces, quite two-thirds of the floor space could be saved; and where three meltings a day were obtained by the old methods, it was possible to get six without lengthening the working day by one hour, or without pushing the men to secure the enhanced output. Brass founders knew to their cost the difficulties and serious delays experienced in the melting of metals by present methods when unfavourable weather conditions prevailed. With gas, these troubles could be overcome. Manufacturers who were at the limit of their resources in workshop accommodation should seriously consider the adoption of gas under air pressure. By its means their output could be practically doubled, thus obviating the need for larger premises and the sinking of further capital in new buildings. For the immediate past half year, sales of gas by meter and under contract amounted to £332,338, as compared with £310,248 for the December half of 1914—an increase of £22,090; while residuals accounted for

£77,848, against £72,678 for the corresponding period of 1914—an increase of £5170. The total revenue for the half year was thus £27,260 in excess of the December half of last year. The balance available for net revenue account was £132,507, as compared with £143,072 in the same period of 1914. The reason for this was to be found by the comparison of the various items of expenditure which, in nearly every instance, showed large increases over 1914. There were higher prices for coal, increases in wages, and an enhancement of the cost of all material required for repairs or use at the works, or for distribution purposes. These heavy increases, especially in freight, cost and carriage of coal and labour, not to speak of taxation, would considerably enhance the expenditure in the coming half year. During the six months about 21 miles of mains had been laid, and 62 miles of services. These figures included about 2½ miles of trunk mains laid in South St. Kilda, Garden Vale, Malvern, and Coburg. The amount written-off this half year for bad and doubtful debts was larger than in recent years, during which the usual figure had been of a very moderate character. The Directors had made contributions to the various patriotic funds out of the profits of the half year, to the amount of £2700. A very substantial percentage of the Company's employees—240 men—had demonstrated their patriotism by enlisting in the Expeditionary Forces. The Company had agreed to make up their military pay to their regular earnings; and this had amounted to £2567 for the half year. One of the employees had gained the distinction of a V.C. The Directors had forwarded to Corporal Issy Smith, the employee in question, a letter of congratulation, together with a cheque for £50. The Directors had hoped to be able to report the trial results of the new installation of Woodall-Duckham vertical retorts just nearing completion at West Melbourne; but this would have to be left to a future meeting.

The motion having been seconded and carried, a dividend of 6s. 6d. per share was declared out of the profits of the half year ended Dec. 31.

SHEFFIELD UNITED GASLIGHT COMPANY.

Increased Consumption in Spite of the War.

The Ordinary General Meeting of the Company was held on Monday of last week—Mr. Wilson Mappin, J.P., presiding.

The Chairman, in moving the adoption of the report and accounts [particulars of which were given on p. 429 of the "Journal" for the 22nd ult.], said the first thing that would strike the proprietors in the accounts was that the capital was overspent at the end of the year by £69,818. In February, 1915, the Directors applied to the Treasury for permission to issue £50,000 of debenture stock. The reply received was that no objection would be raised to them doing so, if they would give an undertaking not to expend any of the money except in connection with the supply of gas to firms working on munitions of war. Under the Company's Acts they were obliged to connect customers whose premises were within a certain distance of the mains; and this being so, it was impossible to give the required guarantee. The Treasury were asked if they had power to relieve the Company of this obligation, and whether they would indemnify them against any action that might be taken on the part of a would-be consumer. Their answer was that they could not alter their previous condition. This attitude struck one as being absurd, and gave one a poor opinion of the capacity of the person or persons who would deal with the matter in such a manner. The money the Treasury refused to allow them to raise economically had had to be obtained from their bankers. While negotiations were proceeding, the Government issued their 4½ per cent. War Loan; and it was therefore useless to continue the controversy, as it was not to be expected that people would take up debenture stock at 4 per cent., when they could have Government security at 4½ per cent. The management of the business during the past year had been beset with many difficulties, not the least being the obtaining of a sufficient number of men to carry on the works. Applications were made to the Labour Exchange, and also to the Ministry of Munitions, who, though they were very prolific with their promises, failed to give any assistance. He would like to mark the appreciation of the Board of the help rendered by a number of the Company's officials, who, with the Engineer (Mr. J. W. Morrison) and several of the Directors, and one or two gentlemen not connected with the Company, volunteered assistance. They assisted in loading-up coal for the retort-houses, and coke into railway-waggons. This was a considerable gain; and it was right that the shareholders should be informed of the good spirit which had actuated the staff. They were employing female labour as far as possible, and had at present about ninety women at the works. The number of men who had joined the Forces was 329. The staff of clerks and meter inspectors had also been diminished from the same cause; and they had replaced them (temporarily, they hoped) by female assistants. The Directors were asked by the High Explosives Committee if they would consent to the erection by the Government of plant for the extraction of toluol and benzol from the gas; and the plant was working satisfactorily. The securities in which the reserve fund was invested had naturally suffered depreciation; and it had therefore been necessary to write-down the investments by a further sum of £13,498. The Directors had effected an insurance on the works under the Government scheme against air-raid risks. It was with the utmost reluctance that the Board found themselves compelled to advance the price of gas in July last by 6d. per 1000 cubic feet. It had always been their aim to supply at the lowest possible figure; and other towns had cast envious eyes on the consumers of Sheffield, who had benefited to the extent of hundreds of thousands of pounds by the careful management of the Company in the past. In addition to war bonuses to the workmen, and allowances to dependants of men who had enlisted, everything that the Company used had cost more. Notwithstanding the curtailment of public lighting, the increase in the quantity of gas sold had been considerable—5·75 per cent. over 1914. This was not surprising, considering the general activity of trade in the city at the present time. In the last four weeks (since the cold weather set in) no less than 60,721,000 cubic feet had been consumed in excess of the corresponding weeks of last year. Coal showed an increased cost of £54,852. This would have been more, but for the fact that the Company had fairly favourable contracts running during the first half of the year, and that there was a considerable quantity in arrear which was not delivered until after June 30. On the other hand, they received £74,801 more for gas, partly accounted for by the increase in price, and partly by the additional quantity sold. The net result was that, whereas in 1914 they were £34,735 short of the amount required to pay the dividend, they were now able, after writing-down the reserve fund investments, and providing for the dividend, to add to the sum carried forward £8713, which would amount to £65,002. The reserve fund stood at the authorized amount of £86,848. There were 1387 extra meters fixed, and 77 additional gas-engines, varying in size from 2 to 550 H.P.—the total being 3583 H P. The quantity of gas used in engines during the year was 789.630,000 cubic feet. There had been a considerable extension in the use of gas for industrial purposes; the Company having sold furnaces to the value of £9584, with a capacity for the consumption of 96,985 cubic feet of gas per hour. It was with regret that the Company relinquished the maintenance of consumers' burners; but as this was work that could be done by customers individually, they felt that it was their duty to set free the number of young men who were engaged on the work. Though it was too much to hope that all their employees who were on active service would return, the Directors trusted that most of them might again fill their respective places, which were being kept open for them.

The report was adopted; and a resolution was passed declaring a dividend of 5 per cent. on the "A," "B," and "C" stocks for the half year ended Dec. 31.

LEA BRIDGE DISTRICT GAS COMPANY.

Satisfactory Increase in Business.

The Half-Yearly General Meeting of the Company was held last Tuesday, at the Offices, Nos. 63 and 64, Chancery Lane, W.C.—under the presidency of Mr. A. M. Paddon, the Chairman.

The Secretary (Mr. Richard Sandell) read the notice convening the meeting; and it was agreed to take as read the report of the Directors and the statement of accounts.

The Chairman remarked that the report showed a very satisfactory increase in the business, at a time when they were not in a position to expect it; and the dividends had been maintained, in what might be called a precarious period. The capital expenditure in the six months ended Dec. 31 had been £4371; but this sum was only £1659 in excess of the amount written off for depreciation. This reduced sum was well accounted for, having regard to the increase of 12 million cubic feet in the quantity of gas sold. If they allotted to this extension of business £500 of capital per million feet sold, it would represent a sum of £6000 which they could have spent in the half year without altering the very satisfactory ratio of capital expended and gas sold. At the present moment, making allowance for amounts added on conversion, the capital expended was only £605 per million cubic feet, which, for a company of their size, was very good. On the credit side of the revenue account, the receipts for gas were in excess of those of the corresponding period of the previous year by £3233; and this figure was somewhat improved by the fact that public lighting was £203 less. An increase of £104 in rental of meters, indicated that the business was extending healthily as regarded the number of consumers. In respect to residual products, they were able to report an accretion of receipts in every detail. Coke and breeze had brought in £2156 more; tar, £57 more; and ammoniacal liquor and sulphate of ammonia, £690 more. On the other hand, coal, oil, and coke had cost just over £3000 additional—partly, of course, owing to the increased business. With reference to the item of repairs and maintenance, there had been spent on works and plant an amount equivalent to 6·39d. per 1000 cubic feet of gas sold; on mains and services, 1·8d.; on meters, nearly 2d.; and on gas stoves and fittings, more than 5d. These figures in the aggregate amounted to close upon 1s. 3½d. per 1000 cubic feet; so that, whatever the results in the accounts might be, it would be seen that the Board had the situation well in hand. Insurance was £361 more, owing to provision having been made in regard to possible damage by air-craft. Payments to dependants and war bonuses had increased by about £350. The profit and loss account showed that, whereas they brought in £5885, they were taking forward £5808, or only £77 less. On this occasion, no contribution was being made from revenue to the reserve fund; but six months ago a sum of £644 was transferred. The benefit fund had been credited from revenue with £186; but there had only been disbursed £164, and there was £314 invested by deposit in the bank. It was advisable to have a fund of respectable proportions, in view of uncertainty as to the future. The balance-sheet was very satisfactory. There was cash at the bank, in hand, and on deposit amounting to £10,000, which was a very gratifying entry at times like the present. Now as to the future. The ground in front was more difficult than that which had been already traversed. They could not expect to do quite so well during the next six months as they had during the past, because the burdens would be greater; but there were no very exceptional difficulties to deal with in the Company. Getting their coal by rail, as they did, the Directors did not think the supplies would be seriously disturbed. Like everyone else, they were experiencing difficulty in getting exactly what they required; but they believed the Government would see that they had it in the long run. One effect of this great war had been to show, to the Government primarily, and to the public in the second place, how vastly valuable the gas undertakings were to the country at large. In a vague sort of way, this was beginning to be grasped, though its full extent was not yet realized. The first great value of the gas industry to the country was that it provided for the most economical use of fuel. It used all the coal up, and wasted none. This was a national factor of inestimable value. He concluded by moving the adoption of the report and accounts.

Mr. G. W. Carey seconded the resolution, which was agreed to.

On the proposition of the Chairman, seconded by Mr. A. F. Phillips, dividends were declared (less income-tax) at the rate of 5 per cent. per annum on the preference stock and 6½ per cent. per annum on the consolidated ordinary stock.

The retiring Director (Mr. J. M. Miles) was re-elected, on the motion of the CHAIRMAN, seconded by Mr. PHILLIPS; and the retiring Auditor (Mr. James Randall) was also re-appointed.

The CHAIRMAN, in proposing a hearty vote of thanks to the officers and their staffs, remarked that the figures he had quoted showed to what an extent such a vote was justified. Mr. Cross, especially, had had to effectuate an important change in the technical outfit on the works; and his difficulties must have been very great. He had struggled successfully with them, and the Directors owed a great deal to him. They had also had loyal co-operation from Mr. Sandell.

Mr. E. L. BURTON seconded the vote, which was cordially passed.

Mr. CROSS, in the course of his acknowledgment, said that, having completed twenty years in the service of the Company, a few comparisons might be of interest to the proprietors. In 1895—the year previous to his coming to Lea Bridge—the make of gas was 87 million cubic feet; whereas last year it was 505 millions. At the earlier date there were no prepayment consumers; but the ordinary consumers numbered 1350. The total at the present moment, including slots, was 23,723. There were 225 cookers in 1895; now they totalled 18,187. He hoped that in another twenty years he might be able to give them some better figures still.

A vote of thanks to the Chairman and Directors brought the proceedings to a close.

JOHN WRIGHT AND EAGLE RANGE.

The Annual Meeting of the Company took place in Birmingham, last Tuesday—Mr. H. JAMES YATES presiding. The report was adopted, which was noticed in the "JOURNAL" for the 7th inst. [p. 554.]

The CHAIRMAN, after referring to the war and the commercial interests of the nation, went on to deal with the Company's business. He said that, in addition to the fact that a great proportion of their output today is for actual war work and appliances for use in military camps and hospitals, all gas-consuming apparatus, of which the Company were the largest makers, had a peculiarly great value at the present time with relation to the manufacture of munitions. This being so, the Ministry of Munitions some months ago issued a circular to all the munition factories in the country urging them to use gas appliances for every possible process in munition manufacture. But notwithstanding this official pronouncement, and the obviously vital relation that it established between gas output and that of munitions, in various official quarters the importance of this aspect of things was very far from being realized. It would be unspeakably unfortunate if military officials, or if the Tribunals generally, were to act upon the view that, because gas manufacture was one remove away from actual munition manufacture, it should be treated as a negligible factor, and businesses like their own be allowed to lose indispensable employees, either by their being taken for military purposes, or being permitted by Munitions Tribunals to give up their present employment. The Company were now contributing to the support of over 600 dependants of employees who had left to serve the country. For years past, he had been able at the Company's annual meeting to report that the year under review had been a record one, both for turnover and profit; but on this occasion he was not in such a fortunate position, though, had they been able to find sufficient men and material, and to get these at anything like normal cost, the turnover would have greatly exceeded that of any previous year, and the profits would have shown a proportionate advance. They had had the orders, but had not been able to deal with them. The adverse effect of the war conditions upon the profits had been most marked in the gas-stove section of the business. Fortunately, however, during the past year they had been reaping a very greatly increased benefit from their subsidiary businesses, and also from the industrial apparatus or furnace department, which had during 1915 grown in a manner beyond anything that they could have hoped to attain. This he attributed to the policy they originated in the gas-stove trade a number of years ago, of spending thousands of pounds annually in research and experimental work. In respect of the range of industrial apparatus manufactured in their Essex Works and by the Brayshaw Furnaces and Tools, Limited, they held to-day a position of unassailable strength. Their cash position continued to be extremely satisfactory. As a result of having disposed of their unissued shares in purchasing various businesses, they had now practically no more share capital available; and at the present time they had before them the possibility of further similar arrangements. They therefore thought that this was an opportune moment to ask for powers to increase the share capital; and it had been felt that, while they were doing this, it was desirable to make the increase a large one, so that there might be sufficient shares available to meet any further contingencies which might arise. There was a large sum employed in the business which was not represented by shares; and in asking the shareholders to sanction the increase of the share capital, the Directors had, after careful consideration, decided that if the Treasury should prove willing to give their consent, the Company should capitalize some of the money which was now represented in the business by reserves. These must not be taken as being in any sense bonus shares, as the object was to bring the amount of the issued share capital more closely into line with the capital which was actually employed in the business, and without which the present profits could not be earned. The suggestion was to issue three additional ordinary shares for every five shares held to-day. This arrangement would bring the rate of dividend down to the very reasonable figure of 12½ per cent.; and assuming that the profits were maintained, these eight shares would continue to bring to present holders of five shares precisely the same income as they had hitherto received.

The report was adopted; a dividend of 2s. 6d. per share, free of income-tax, was declared on the ordinary shares; and at a subsequent meeting it was unanimously agreed to increase the share capital of the Company from £300,000 to £750,000.

THE MAIN GAS FIRES.

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ST. NICHOLAS—
The Gas Fire
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The new booklet— Main Reflections"— contains particulars of several new Gas Fires. Copies free on application.

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SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

The ST. NICHOLAS.

METROPOLITAN COUNCILS AND THE GAS SUPPLY.

The Suggestion of the Ministry of Munitions.

At the Meeting of the Lambeth Borough Council last Thursday, the Lighting Committee reported having had under consideration communications from the Ministry of Munitions, forwarding notices which have been issued to gas companies requiring the extraction of certain constituents needed for the manufacture of explosives, and suggesting, in these circumstances, that the Council should do everything in their power to prevent attacks being made on the gas undertakings, owing to any possible deterioration in the quality of the gas supplied, either by ceasing to test the gas altogether, or, at any rate, by preventing the result of the tests from being made public. The Committee instructed the Clerk to communicate with the London County Council, inquiring whether they would continue to test the gas and issue reports of such tests, to which a reply had been received that the Council had decided to suspend, for the present, the publication of the results of the usual daily tests of gas supplied; otherwise the ordinary procedure would be continued.

"The County Council also stated," the Committee's report continued, "that they were naturally anxious not to take any action which might in any way appear to interfere with the due prosecution of the measures deemed to be necessary to meet the national requirements. The possible deterioration in the quality of the gas raises, however, the important question as to the relation which exists between the shareholders and the consumers under the sliding-scale conditions governing price and dividend. The County Council are of opinion, and in the past have successfully contended, that any saving due to the manufacture of a lower quality gas should enure entirely to the benefit of the consumer. In the present case, it would consequently follow that the whole value of the products extracted from the gas in excess of those necessary to maintain the gas at its standard quality should be similarly applied. The question whether any definite action had been taken in this direction would, however, require careful consideration; and, while unwilling to suggest that there should be any forfeiture in respect of deficiencies, the County Council felt that it may hereafter be found necessary to require the companies to give some compensating advantage to the consumers. The position would consequently be reviewed after a period of about three months, when further information would be available as to the actual results of the action taken.

"On Jan. 20, a communication was received from the Town Clerk of Kensington, stating that his Council are assured that gas companies can, in a very great measure, by a process of artificial enrichment, make good any loss of illuminating and calorific power occasioned by the withdrawal from their gas of the constituents which the Government are requiring; and in these circumstances they do not agree with the suggestion put forward by the Ministry of Munitions, and have urged that the testing of gas by the County Council shall continue as heretofore. In reply to our request that the Kensington Council would furnish us with any data upon which the Lambeth Borough Council could take action along the lines suggested, a letter has been received stating that such data were of a confidential character, and could not be furnished as desired. It was also stated that it is generally admitted that the gas companies have found it necessary from time to time artificially to enrich their gas, particularly water gas, in order to bring it up to the standards of illuminating and calorific power in force under normal conditions; and that it might reasonably be contended that such 'enrichment' should be resorted to in a greater measure, so as to make up for the reduction in quality brought about by the extraction of the constituents required by the Minister of Munitions. The Kensington Council, however, did not go so far as to put forward the above contention; but they considered that gas consumers were entitled to know the quality of the gas supplied to them, even if the quality be lower than the usual standard. It was felt that the publication of the lists by the London County Council would, to some extent, ensure the quality of the gas being kept up to the reasonable standard"

Having regard to all the facts, the Committee stated that they had come to the conclusion that the Council should support the action which has been taken by the Kensington Borough Council; and they recommended accordingly. This was approved of.

Farnham Trench Fatality.

An action has recently been tried at the Surrey Assizes which arose out of a fatal accident at Farnham last June. Albert Masters, a drayman employed by Messrs. Watney, Combe, Reid, and Co., was returning home from a round late one night with his van, when, for some reason or other, both horse and man fell into a trench excavation made by the Farnham Gas and Electricity Company, in connection with gas-main laying operations. The connection between the new and the old mains was broken, the gas became ignited, and the man was burned to death. The horse, also, was so injured that it had to be killed. Mrs. Masters sought to recover damages for the loss of her son, who was, she said, her sole means of support; and the brewers, too, claimed damages. The facts of the case were fully gone into at the inquest, which was reported in the "JOURNAL" for June 22 [p. 710]. Mr. Elliott, K.C., urged that the barrier was improperly placed and insecurely fixed, and that the lighting of the spot was insufficient. Mr. Dickens, K.C., for the Company, said deceased, after nearly eighteen hours' work, must have been dozing, or not looking out. Deceased knew the trench was there, as he had passed it every day for a month. Witnesses were heard; and the Special Jury found the Company had not been negligent, and that deceased had been guilty of contributory negligence. Mr. Justice Bray therefore entered judgment for the Company in both actions.

A Belfast Coroner's Jury returned a verdict of "Accidental death" in the case of James Webb, aged 77, who was found in an unconscious condition in his bed-room; a gas-jet being turned on fully.

After the War.

¶ It is anticipated by economists that industrial and other conditions consequent upon Peace will impose as severe a strain on commercial adaptability as those developed by the continuance of War.

¶ In our own case, we believe that the intricate difficulties of labour, material, organization, and transport, which have had to be surmounted during the past twelve months, will be seen to have made for INCREASED STRENGTH, and that our technical facilities will prove fully equal to whatever demand may then be made upon them.

THE DAVIS GAS STOVE CO., LTD.,
The Gas Exhibition Salons,
60, OXFORD STREET, LONDON, W.

GOVERNMENT TRIBUTES TO SOUTHPORT GAS OFFICIALS.

At a special meeting of the Southport Gas Committee last week, the Chairman (Mr. Richardson) reported the receipt by him of the following letter from the Department of Explosives Supplies of the Ministry of Munitions of War:—

> Sir,—I am directed by the Minister of Munitions to express the hope that your Committee will be able to grant the release from its employment of Mr. Whitehead, Assistant Engineer, to the service of this department. His work will be entirely connected with gas-works, from which it is hoped to increase still further the present production of the raw materials for explosives purposes. In view, therefore, of the urgent national requirements for these at present, it is hoped that your Committee will be able to consent to his release at the earliest date possible.
>
> I am to take this opportunity of referring to the very valuable assistance which this Department has been receiving from your Engineer, Mr. Bond, and to thank you again for having enabled him to devote so much time and attention on its behalf.
>
> (Signed) F. L. Halford.

The Committee at once gave their consent, and Mr. Whitehead (who is a native of Birmingham, and recently took his B.Sc.) left Southport for London. His duties at Southport have been those of draughtsman and chemist; but since the war commenced, a good deal of experimental work has been carried out, and it is in connection with this that Mr. Whitehead's services are now required by the Government. The tribute to Mr. John Bond is well deserved. He is a member of Lord Moulton's Committee, and in this capacity has been visiting various works giving instructions.

◆

The Dublin Public Lighting Committee, in their estimate for the coming year, remarked that one of the difficulties to be faced is the fact that the price of glasses has gone up from 39s. to 114s. a gross.

The Davis Gas Stove Company forward photographs of some of a series of artistic and concisely worded advertising cards which are being displayed in the windows of their Oxford Street exhibition salons. As a series, the cards deal comprehensively with the purposes of the salons, to visit which they furnish a cordial invitation; and it is not surprising to learn that many visitors are being attracted by them. One notices in them the following, among other, interesting questions: "Would you like to see the kitchen-range supplied to H.M. the King?" "Would the fire-grates adopted by Royalty and Cabinet Ministers interest you?" The answer is: "If so, inspect the exhibits in the salons within."

NOTES FROM SCOTLAND.

Great Reduction in Edinburgh and Leith Public Lighting.—The greatly reduced consumption of gas for public lighting purposes in Edinburgh and Leith has already been referred to in these columns; and it was made strikingly manifest by the Engineer (Mr. Alexander Masterton) in some figures he submitted to the meeting of the Commissioners on Monday of last week. For the year 1913-14 the consumption was nearly 81 million cubic feet, value £9098; in 1914-15 it fell to 61 millions, value £6837; and in 1915-16 to 10 millions, value £1155. The Commissioners decided that the current rate charged to private consumers—3s. 4d. per 1000 cubic feet, with rebates according to a graduated scale of consumption—should apply also to the Corporations of Edinburgh and Leith for gas to be used by the street lamps during the ensuing year. The "Edinburgh Evening Dispatch" points the moral of this lighting economy by remarking: "Though the unwonted darkness in the city has been the cause of no small inconvenience and some annoyance to many people in Edinburgh, the gloomy cloud still has its silver lining. Before the war started, we were in the habit of paying over £9000 for the gas consumed in public lighting. Last year the cost was only £1155. Here is a saving of about £8000, or two-thirds of a penny in the pound on the rates. Our very trials may yet prove an education in economy." It is doubtful whether the lighting of the streets will be carried out after the war on quite so liberal a scale as that which obtained in pre-war days; for, at a meeting of the Cleaning and Lighting Committee of the Edinburgh Town Council, held the same day, the Lighting Inspector was instructed to report as to how many gas-lamps could be dispensed with, and what reduction might be made in the illuminating power of the electric lamps.

Female Workers in the Glasgow Gas Department.—As an example of the extent to which the gas industry is, where practicable, utilizing female labour to replace men who are needed for the Forces, the case of the Glasgow Gas Department may be cited. Here, out of 700 odd employees who have joined the Colours, nearly 100 were meter inspectors and clerks. To take the places of these men, 90 women are now employed in the department, of whom 57 are meter inspectors. In the "Journal" last week, it was stated that, before the Exemption Tribunal in Glasgow, an employee of the Corporation who appealed said he had a badge and certificate from the Ministry of Munitions, and was chief clerk and meter inspector in the Gas Department. As a matter of fact, the man referred to was an employee of a neighbouring corporation. The statement which appeared last week, that there are "a lot of women doing work as meter inspectors in Glasgow, and they are doing it very well," we are now able to supplement by the figures quoted above. The women have, it seems, been at work for several months, and are giving every satisfaction.

Big Demand for Gas in Glasgow.—There has recently been experienced a great increase in the demand for gas within the area supplied by the Glasgow Corporation Gas Department. In addition to the large quantity now being used in engineering works busy on

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Government contracts, it is said that the consumption has lately been increased through the high price and shortage of coal having induced householders to use gas-fires. Having had before them a report as to the stocks of coal at the various gas-works, the Gas Committee remitted to certain members, with the Engineer and General Manager (Mr. Alex. Wilson), to take such steps as they might deem necessary in the circumstances, in order to obtain adequate supplies of coal.

Perth Gas Workers' Wages.—There was some discussion in the Perth Town Council last week on the award of Sheriff Mackenzie, giving the Corporation gas workers an advance in their wages. There was a recommendation of the Gas Committee that the increase granted by the award should apply also to the hot-coke wheelers and others mentioned as excepted, and that the Council discontinue the privileges which are at present granted to the men outside of their wages. When the matter came up for consideration, Lord Provost Scott stated that the award of the Arbitrator was not yet completed. He made very palpable mistakes; and they had called the attention of the Board of Trade to these. In the circumstances, he had to ask the Council to postpone consideration of the question until the corrected award was in their hands. This suggestion was ultimately adopted.

An Edinburgh Gas Explosion Claim.—An action, in which £500 damages are claimed, has been brought against the Edinburgh and Leith Gas Commissioners by Miss Violet Waddell, of Edinburgh, who states that, on the evening of Dec. 10, she was conversing with her aunt on the pavement when a violent explosion took place in a house on the opposite side of the street. She was struck in the face by broken glass, and a basin was hurled against her. She alleges that her sight has been seriously injured, and that she has suffered from shock. In her statement of claim, she imputes fault to the defendants, in respect that they knew that there was an escape of gas in the house in question, and culpably neglected to remedy the defect. The defendants deny fault, state that claimant has exaggerated her injuries, that the condition of her eyesight has not been caused or aggravated by the accident, that they are not responsible for the maintenance or repair of internal pipes and fittings beyond the meter, that there was no defect in the pipe-connections between the main and the meter, and that the workman who temporarily stopped the leakage with white lead did so without the authority of the Commissioners.

Charge of Stealing Gas.—Robert Murray, an old man of 69, a plumber by trade, was charged in the Edinburgh City Police Court on Tuesday last with stealing from the Commissioners 3000 cubic feet of gas. The meter had been removed from his house some months ago; but on the 10th ult. one of the Commissioners' inspectors noticed that a piece of rubber-tube had been attached to the service pipe, which entered the accused's house through the top of the kitchen window. On making investigation, the inspector found that the tube supplied gas to a jet, a griller, and a hot-plate. It was stated in defence that gas was escaping from the pipe; and that Murray, rather than it should be wasted in the open air, thought he would put it to practical use. The argument, however, made no impression on the Magistrate, who sentenced the ingenious plumber to twenty days' imprisonment.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *March* 20.

The London tar products position is unchanged. Notwithstanding freight difficulties, shipments of pitch are made from time to time. The makers' export price for this article remains at 19s. to 19s. 6d. net per ton f.o.b. at works. Values generally are unaltered.

Sulphate of ammonia is still held-up from export owing to the absence of licences, although it is quite clear that more sulphate is being reserved in the United Kingdom than the country needs. The price is nominally unchanged for export—a special price ruling for home agricultural purposes.

Tar Products in the Provinces.

March 20.

There is nothing fresh to report concerning the markets for tar products. Pitch remains unchanged. Slight business is being done in creosote. There has been a little inquiry for solvent naphtha during the past week; but the prices quoted are quite reasonable. Heavy naphtha is in fair demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 16s. to 20s. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., London, 1s.; North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2½d. to 2⅝d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *March* 18.

A fair demand has been experienced from one or two quarters, but prohibition has still stood largely in the way of business. Consequently, there has been no change in the position of this material throughout the week, and quotations have remained at £16 17s. 6d. per ton f.o.b. Hull, £17 f.o.b. Liverpool, and £17 2s. 6d. f.o.b. Leith for early shipment. For future delivery little interest has been shown, and no transactions have been reported.

Nitrate of Soda.

The market for this article has continued very firm, and holders

The "Acmefont" Gas-Heated Boiler.

The "Acmefont" is specially suitable for warming Cubicle Buildings used for Sleeping Accommodation, Sick Bays, Changing Clothes, &c. The heating of each hut is under separate control, and this system of heating possesses advantages in

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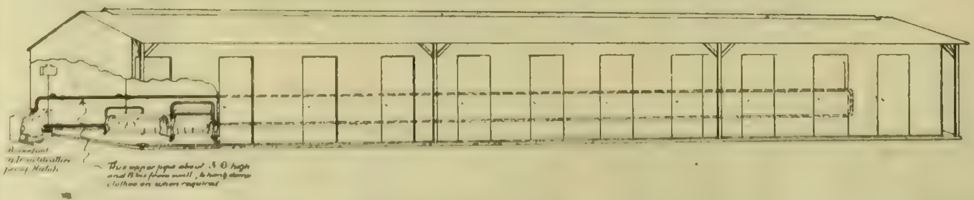

ARDEN HILL & CO.,
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now require 17s. 3d. per cwt. for ordinary quality, and 18s. for refined, on spot.

Sulphate of Ammonia.

From another source it is stated that to-day's values of this article are as follows: Outside London makes, £15 17s. 6d. to £16; Hull, £16 12s. 6d.; Liverpool, £16 15s.; Leith, £16 17s. 6d.; Middlesbrough, £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The uncertainty of the supplies of coal affects the Northern coal trade rather unequally as between the steam coal and gas coal branches. In the steam coal trade, there is a good demand, and tonnage seems relatively more plentiful. Best Northumbrian steams are from 32s. 6d. to 34s. per ton f.o.b.; and for second-class steams, the current quotation is from 28s. 6d. to 30s. per ton. Steam smalls are generally firm —the various classes being from 15s. to 18s. 6d., so that smalls are at good prices, which may be stiffened as the exporting season grows nearer. Much, however, as to the actual price paid for cargoes depends on the possibility of prompt or early shipment; for the output is fair, and the question of ready loading is one of the chief factors. In the gas coal trade, the subject of early shipment is also prominent— more so perhaps because freights are higher in the foreign than in the coasting trade. In gas coal, best Durhams are about 25s. 6d. per ton f.o.b.; second class gas coals are about 24s. per ton; and "Wear Specials" are 27s. per ton f.o.b. It is possible that, in a few instances, these quotations may be discounted a little when steamers can be offered for prompt loading. There are several substantial contracts for gas coal in the market; but the details are not yet known, though it is probable that the legal addition to former contract prices will largely decide the actual figures to be paid. Freight quotations for gas coal seem based now on about 15s. from the Tyne to the Thames; while to some of the Mediterranean ports, there are freights quoted that are relatively much higher than these, and seem likely to continue. The difficulty, therefore, as to fixing ahead is found greatly to affect forward sales even at the high delivered values that now prevail. Coke is steady with full exports. Gas coke does not show much change; and the quotation for good makes is 27s. 6d. to 29s. per ton f.o.b. Tyne.

The report to be submitted at the annual meeting of the Davis Gas-Stove Company on Friday states that the net profits for the year ended Dec. 31 amount to £15,490; and adding the sum of £7703 brought forward, makes a total divisible profit of £23,193. It is proposed to pay a dividend on the ordinary shares for the half year at the rate of 15 per cent. per annum, making (with the interim dividend at the rate of 5 per cent. per annum) 10 per cent. for the year, less income-tax; to contribute £3000 to the provident fund; and to carry forward (after providing for the proportion of profits payable to the Directors) £10,817.

Plymouth Gas Bill Unopposed.—The Bill of the Plymouth and Stonehouse Gas Company, which was to have come this week before a House of Commons Committee, will, all the opposition having now been withdrawn, in due course be referred to the Select Committee on Unopposed Bills.

Dublin Electric Light Failure.—On two occasions last week, the Corporation electric lighting current in the Glasnevin and other northern suburbs of Dublin failed early in the evening, with the result that streets, business establishments, and private residences were left in darkness for considerable periods. Much annoyance and inconvenience arose. The City Electrical Engineer stated that the breakdown was due to "something having gone wrong with a fuse."

Higher Prices at Bourne.—At the last meeting of the Bourne Urban District Council, a report of the Gas Committee was adopted recommending that the price for gas be increased to 4s. 7d. per 1000 cubic feet to private consumers, 4s. 10d. for slot-meters without cookers, and 5s. 1d. for slot-meters with cookers. It was pointed out that prepayment meter consumers using cookers had to burn 13,000 cubic feet of gas per annum to make their prices equal to those of ordinary consumers.

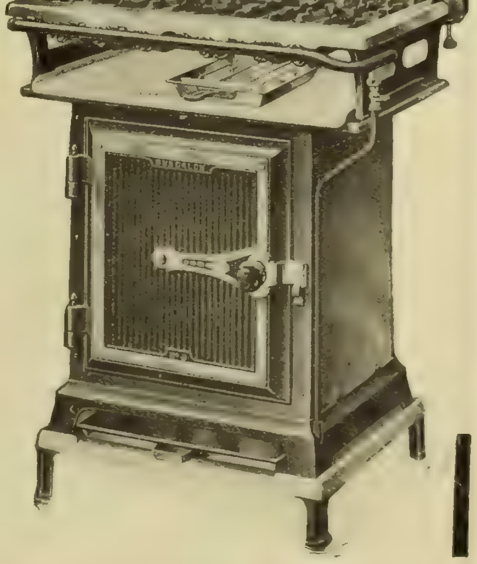
Mishap at the York Gas-Works.—In last Wednesday's issue, the "Yorkshire Post" stated that on the previous evening "the city of York was thrown into partial darkness so far as householders who rely on gas lighting were concerned. It seems that in the morning a small explosion occurred in the water-gas plant. The explosion, slight in itself, damaged a pipe, the repairs to which occupied till 7 o'clock in the evening, during which time the plant was idle. The accident was particularly unfortunate, owing to the fact that there was a comparatively small amount of gas in stock at the time; and when the demand on the stock had been in operation for about an hour, it almost entirely gave out. The supply improved later in the evening."

The Leiston Gas Dispute.—The Directors' report, which was unanimously adopted at the meeting of the Leiston Gas Company, stated that the results compared favourably with former years, notwithstanding the continued restrictions on lighting. No increase in the price of gas had been made, though much higher prices were being paid for coal and other materials, and the markets were still on the upgrade. A regrettable difference of opinion had arisen with the Urban District Council owing to the street lighting having been prohibited by the military authorities early in the year. The Company offered to make a reasonable allowance; but the Council refused to consider it, or to make any counter proposal, and, in fact, declined to pay anything at all. The Company were, therefore, reluctantly compelled to take legal action; and judgment was given in their favour, with costs. The Council were appealing against this judgment. Pending the final decision, a considerable sum, and also an amount to meet possible costs, had been carried to reserve in the accounts; and the Directors had decided to reduce the dividend, which had in the past two years been paid at the rate of 5 per cent. per annum, to 4 per cent.

Richmond's Bungalow Cookers

SUPPLIED in four sizes, Richmond's 'Bungalow' Cookers contain many special features of great practical utility. The Oven raised to prevent stooping; the hygienic advantage of the raised stand avoiding collection of dirt beneath cooker; the convenient hotplate with patent griller of increased efficiency, and the rack (Patent No. 4975/1914) holding plates in vertical position, are all features which strongly appeal. Right hand illustration shows the new size 'Bungalow' No. 3.

The RICHMOND
Gas Stove & Meter Co., Ld.,
London and Warrington.



Woking District Gas Company.

Reporting to the shareholders on the working of the past half year, the Directors of the Company stated that the sales of gas showed a decrease of 6·19 per cent. over the corresponding period of 1914, principally owing to the extinction of nearly all the public lamps. The receipts from residual products, however, increased by £186. The revenue for the half year was £11,231, and the expenses on revenue account £9079, leaving a net profit of £2152 to be carried to profit and loss account, to which must be added the balance brought forward from the last account (£2168). After charging £287 interest on debentures and loans, there remained an available balance of £4032. The Directors recommended the payment of dividends on the preference stock at the rate of 5 per cent. per annum, and on the "A" and "B" ordinary stocks at the rate of 5½ per cent. per annum, which would absorb £1739, leaving the sum of £2293 to be carried forward. In accordance with the authority given to the Directors at a special general meeting, they offered privately for subscription £10,000 of 6 per cent. redeemable debenture stock; and the whole of this stock has been taken up at par. The money was required in order to pay off the loan from the bankers, as well as to pay for the carburetted water-gas plant recently erected, and to provide working capital.

Ilford Gas Company.

In the course of his remarks to the proprietors at the recent half-yearly meeting of the Company, Mr. William Ashmole, the Chairman, said he was sure the results shown in the balance-sheet would be regarded as highly satisfactory. The general business in the six months ended Dec. 31 had been well maintained; the sale of gas showing a decrease of only 0·07 per cent., when compared with the corresponding period of the previous year. The district being almost purely residential, the loss of consumption caused by the lighting order had not been counterbalanced by extra output for factories. Variations in the quality of coal they had had to buy to take the place of contract supplies which could not be procured, had not only affected the make of gas per ton, but had also caused considerable clinker trouble in the furnaces, and in the water-gas producers. The balance of profit and loss account available for dividend was £25,897. There was a reduction in the amount shown, under co-partnership, brought about principally through the sliding-scale—the rise in the price of gas automatically bringing down the bonus paid to the co-partners. The war bonus at present being paid was 5s. per week to every man over eighteen years of age, and 2s. 6d. to every boy under it. The staff received 5 per cent. war bonus on their salaries; this being paid to everyone whose salary did not exceed £150 per annum. The revenue from the sale of gas was considerably more, owing to an advance of 4d. per 1000 cubic feet. The report was adopted, and dividends were agreed to for the half year (less income-tax) at the rate of £7 7s. 6d. per cent. per annum on the ordinary "A" and "C" stocks, and £5 17s. 6d. per cent. per annum on the ordinary "B" stock.

Comparison of Hastings Gas and Electricity Undertakings.

Referring to the position of the electricity undertaking, as indicated in the "Journal" last week, the Hastings "Evening Argus" says: "Of course, one of our millstones is the electricity undertaking. We fancy that the most rabid advocates of municipal trading will now, like the opponents of national service, have changed their opinion through the war, and be inclined to admit that the lonely furrow we ploughed for some time in supporting the gas enterprise was far-sighted. Ratepayers have now the two reports before them. They have a loss on the rate-supported electricity undertaking, a profit on the privately owned Gas Company! The prospect of a further loss on the rate-owned electricity undertaking; a dividend this half year, and the prospect of a dividend, on the privately owned gas undertaking! A substantial deficit on the ratepayers' concern; a substantial profit balance on the private enterprise! Charge to the ratepayers of several hundred pounds on their own business, 'to have darkness instead of light;' a saving on the gas bills, to have darkness instead of light! The rate-supported electricity undertaking cannot render any national service; the privately owned gas undertaking can and does! As the difficulties of freightage, and increased cost of materials, and lower consumption continue, the burden of the ratepayers for their own Corporation industry must increase; whatever effects from these causes are felt by the privately owned Gas Company the ratepayers will not suffer. Yet with this lesson before us, we have added yet another large rate-supported enterprise to the speculations we shall have to worry about as the months go on. One would have thought the folly of municipal trading had been among the follies we have been only too glad to cast away when confronted by the stern realities of war conditions."

An Agreement in the South Wales Coalfield.—On the conclusion last Thursday of a conference between Sir George Askwith and the representatives of the South Wales Coalowners' and Miners' Federation, on the question of the non-union difficulty, it was announced that a tentative agreement had been arrived at. This, it is understood, establishes machinery whereby no man working in the coalfield will be allowed to continue unless he holds a union card, thus rendering impossible strikes on the non-union question. The proposed agreement is for the duration of the war only.

Yorktown and Blackwater Gas Company.—The business of the Company shows satisfactory progress; the increase in the quantity of gas sold during the year 1915 being over 7 per cent., while the make for the first time in the history of the Company exceeded 100,000,000 cubic feet. The exact figure is 103,242,500 cubic feet, or 6,594,700 cubic feet more than in 1914. The total receipts on revenue account amounted to £22,532, as compared with £18,655; the gross expenditure being £17,554, against £14,909. The balance carried forward is £4978. At the annual meeting last week, the Directors recommended the payment of the statutory dividends.

BY APPOINTMENT.

CARRON

IN the designing, planning, and construction of Carron Cookers, Carron Company have at their disposal the best skill and craftsmanship, coupled with the unlimited manufacturing resources of a highly trained organization dating back to the reign of George II.

This is YOUR guarantee that, in efficiency and reliability, Carron Cookers will do ALL and MORE than is claimed for them.

¶ **Catalogue free on request.**

CARRON COMPANY *Works:* CARRON, STIRLINGSHIRE,
and at Phœnix Foundry, Sheffield.
Show-Rooms: London (City and West End), Liverpool, Manchester, Bristol,
Birmingham, Newcastle-on-Tyne, Edinburgh, Glasgow, and Dublin.

Middlesbrough Gas and Electricity Profits.—The Finance Committee of the Middlesbrough Corporation have decided that no profits shall be taken from the gas and electricity undertakings in relief of the rates. Owing to the refusal of the Local Government Board to sanction capital expenditure during the war, it will be necessary to utilize the profits of these undertakings for any requirements this year.

Romford Gas and Coke Company, Limited.—At the half-yearly meeting of the Company, the Directors submitted a report which stated that the revenue profit carried to profit and loss account was £3954; the addition of sums of dividend and interest making the gross profit £4122 for the half year ended Dec. 31, to which had to be added the balance brought forward, giving an available total of £8226. The Directors recommended the payment of dividends at the rate of 13½ per cent. per annum on the original shares, and 10½ per cent. per annum on the "B" shares, both less income-tax, for the half year. Owing to the mild weather and continued lighting restrictions, there was a decrease of 3·07 per cent. in the sales of gas, as compared with the corresponding half of 1914. The Directors reported with regret the death last November of Mr. C. W. Boyns, the newly-appointed Manager, and the official changes resulting therefrom, as recorded in the "JOURNAL" at the time.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for March 15.]

NOS. 3307—3679.

COOK, G. A.—"Creosote oil for preservative purposes." No. 3597

GIBBONS BROS.—"Gas producers and furnaces." No 3423.

MASTERS, R.—See Gibbons. No. 3423.

PICARD, H. F. K.—"Production of metallic tar." No. 3668.

SULMAN, H. L.—See Picard. No. 3668.

VISSER, A. P.—"Distributing means in dry gas meters." No. 3518

WILKES, A. H.—"Gas burners." No. 3564.

WINN, P.—See Wilkes. No. 3564.

The Sub-Committee of the Middlesbrough Gas and Electricity Committee empowered to come to terms with the Tees-side Bridge and Engineering Works, regarding a lease by the latter of the old North Ormesby Gas-Works, have agreed to a term of twenty years, at a rental of £200 per annum. The gas-works have been idle since the amalgamation with Middlesbrough two years ago.

STOCK MARKET REPORT.

BUSINESS on the Stock Exchange in general was better last week than the week before. For one thing, there was more of it, though this accession of activity was chiefly perceptible in some of the minor markets and special lines. In the greater departments quietude prevailed; the disposition still being in favour of awaiting the development of State financial measures. But there was a nice cheerful tone, which intensified as the week progressed. The gilt-edged market was in good case; and War Loan and Consols were quite firm. Home Rails were little noticed until near the close, when they improved in response to demand. Americans moved irregularly. Canadians showed new strength; the increased railway traffic returns being remarkable. In the Foreign Market, a feature was the steadiness of the French loan, culminating in an advance towards the close. Brazilian was in demand in view of the country's improving conditions; but Japanese remained easy. South Africans had a temporary check through realization of profits in mid-week, but moved on again subsequently. The Miscellaneous Market showed many strong points. Rubber and oil were active and buoyant, copper fairly so, and shipping came into more notice than of late. In the Money Market there was not much change. Short loans hardened awhile and then relaxed; but discount rates closed firm. Among topics of interest, speculative discussion as to an issue of War Loan Bonus Bonds was damped by Mr. M'Kenna's announcement that they would be illegal. This obstacle, however, even if well-founded, is not irremediable; and the Government may perhaps find no difficulty in changing their minds. An important international financial development is the Anglo-Italian banking combination to promote commercial and industrial undertakings in Italy, which is very favourably received. The Stock Exchange Committee have sagaciously handled the alien-enemy-member question by dealing with individual cases on their merits. Business in the Gas Market shows no change in point either of volume or of values. Prices seem to have quietly settled down to a level at which bargainers are prepared to do business pending new developments.

Bargains done for cash during the week were as follows: On Monday, European 12⅜, 12$\frac{7}{16}$, 12½, Gas Light ordinary 72¼, 72½, ditto preference 74, 74¼, 74½, Primitiva 2¼, ditto preference 3$\frac{11}{16}$. On Tuesday, Bombay 5⅛, Gas Light ordinary 72¼, 72½, 72¾, Primitiva preference 71s. 10½d., 72s. 1½d., 72s. 6d., ditto (1911) 62¼, 62½, South Metropolitan 75½, South Suburban debenture 90. On Wednesday, British debenture 67, Gas Light ordinary 72¼, ditto maximum 59½, ditto preference 74, 74¼, Imperial Continental 60, Primitiva 2⅛, ditto preference 71s. 9d., South Suburban debenture 90. On Thursday, Brentford debenture 74, Brighton and Hove debenture 73, 73½, Continental Union preference 47, Gas Light ordinary 72½, 72¾, 72⅞, 73, ditto debenture 59½, 60, Liverpool 87½, 88, South Suburban 82, ditto debenture 90¼. On Friday, European 12$\frac{5}{16}$, 12$\frac{11}{16}$, Gas Light ordinary 72½, 72¾, ditto preference 74, 74½, Liverpool 87¼, South Metropolitan 76. On Saturday, Gas Light ordinary 72¼, 72½, 72⅝, 72¾, Primitiva preference 71s. 10½d.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div. or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
874,000	„	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	5⅛
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water — 10 p.c.	29—30	6 6 8	..
333,110	10	„	7	7/-	B 7 p.c.	15—15½	4 10 4	..
115,000	10	„	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
734,9[illegible]0	„	„	†11	55/-	Do. New	204—209	5 5 3	..
5[illegible],000	„	„	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	„	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	74
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	„	„	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	67
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	„	„	5⅛	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	„	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	„	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	„	„	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	47
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	5¾	Derby Con. Stk.	123—125	4 16 0	..
55,000	„	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	12⅜—12½
16,327,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke — 4 p.c. Ord.	98—102	4 15 6	72¼—73
2,600,000	„	„	3½	3½	3½ p.c. max.	76—79	4 8 7	59½
4,062,235	„	„	4	4	4 p.c. Con. Pref.	96—99	4 0 10	74—74½
4,674,850	„	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	59½—60
130,000	„	„	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¼	Ilford A and C	151—154	5 2 4	..
65,780	„	„	6⅜	5⅞	Do. B	115—118	5 8 0	..
65,500	„	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	60
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
235,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	87¼—
					B	146—148	4 14 7	
306,083	„	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,375,892	Stk.	July 29	4½	4¼	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 3	..
100,000	50	„	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	„	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4	2⅛—2¼
499,960	5	June 26	5	2/6	„ 5 p.c. Pref.	4¾—5	5 0 0	71/9—73/9
521,600	100	June 2	4	4	„ 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	„ „ „ 1911	..	—	62¼—62½
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo — 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	„	„	10	10	Do. B	222—224	4 9 3	..
523,500	„	„	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75½—76
1,895,445	„	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	82
60,000	„	„	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	„	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	90—90¼
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District — A 5 p.c.	135—138	5 8 8	..
782,275	„	„	6	6	B 3½ p.c.	115—117	5 2 7	..
181,255	„	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	.
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	„	„	6⅞	63/9	„ B 3½ p.c.	129—134	5 2 7	..
108,075	„	„	5/17/8	55/1½	„ C 3½ p.c.	110—115	5 9 0	..
352,000	„	„	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	„	„	6⅜	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	„	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

Ex. Div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

Annie Baker, aged sixty, of Hove, who had suffered from depression, committed suicide by lying down in front of a gas-oven, the taps of which were turned full on, but not lighted.

A copy is to hand of "Proctor's Tables of Equivalents, Gauge Numbers, and Discount Book," by Messrs. Edward Le Bas and Co., Dock House, Billiter Street, E.C. Of a size suitable for the waistcoat pocket, the book possesses no drawback to set against its obvious advantages. Every discount is shown from 2½ to 97½ per cent., by increases of 2½ per cent.; other figures included being 1¼, 33⅓, 66⅔, and 98¾. Every penny is shown up to 10s.; every 3d. from that to 20s. 6d.; and every 1s. from £1 1s. to £5. Useful tables, also, are the English equivalents of metric weights and measures.

In presenting the balance-sheet of the Company as on Jan. 31, the Directors of Messrs. C. & W. Walker, Limited, report that the profit for the past year, after charging Directors' fees and depreciation on buildings and plant and strengthening reserves, amounts to the sum of £14,779. After adding the balance brought forward, there is a sum of £26,684 standing to the credit of profit and loss account, which the Directors recommend be dealt with as follows: Dividend for twelve months of 5½ per cent. on the preference shares, and 10 per cent. (free of income-tax) on the ordinary shares, £7129; to payment of a bonus of 1s. per share on the ordinary shares (free of income-tax), £2464; to carry to reserve (making it £45,000), £5000; leaving to be carried forward, £12,091.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Gas and Water Engineer. Leigh (Lancs.) Corporation. Applications by March 23.
Manager (Warehouses). No. 302, Smith's Advertising Agency.
Showroom Manager, &c. Braintree Gas-Works.
Foreman. Bombay Gas Company. Applications to London Office (Moorgate Station Chambers) by April 4.
Boiler Attendant. Grays Gas-Works.
Stoker and Handy Man. No. 6164.

Meeting.

British Gaslight Company. 11, George Yard, Lombard Street, E.C. March 29. Twelve o'clock.

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Forfar Gas Corporation. Tenders by April 7.
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Taunton Gas Company. Tenders by March 28.

Fire Clay Goods.

Mountain Ash Urban District Council. Tenders by April 4.
Scunthorpe Gas Department. Tenders by April 10.

Oil for Gas Making.

Ashford Urban District Council. Tenders by March 29.

Oxide of Iron.

Salford Gas Department.
Warrington Gas Department. Tenders by March 27.

Tar.

Leigh (Lancs.) Gas Department. Tenders by March 23.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

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EDITORIAL NOTES.

The Institution and Coal Price Interpretations.

OVER the basis price of coal to which the standard of 4s. per ton is to be added, as provided by the Price of Coal (Limitation) Act, confusion is only becoming worse confounded. The interpretations of the Board of Trade as to what is permissible in determining the basis price only institutes a greater indefiniteness than existed previously; and this particularly applies to the expression of opinion on the point in question that Sir T. Ratcliffe-Ellis, on behalf of the Gas Coal Federation, recently obtained from the Board, and which was quoted in our issue for March 7 last [pp. 517, 521]. The inquiry, it will be remembered, that was put to the Board was to the effect as to whether, in ascertaining the corresponding price for the prescribed year ending June 30, 1914—that is to say, for a sale actually effected in that year, and not the deliveries made during the year—it is necessary that the contract of the same buyer should be taken, or whether, if there was a contract with another buyer nearer to the corresponding date of the new sale (providing the coal was of the same description, sold in similar quantities, and under similar conditions), that contract could be taken in fixing the price. The reply of the Board of Trade was that, "so long as the conditions prescribed by section 1 (1) of the Act are complied with, "there is nothing in the Act which requires that reference "should in all cases be made to a sale to the same buyer." We should have thought that the "same buyer" in a transaction (other corresponding conditions obtaining) was not a negligible circumstance. However, the coalowners have not lost any time in putting into operation the extended latitude which Sir Ratcliffe-Ellis ascertained had, in view of the wording of section 1 of the Act, the endorsement of the Board of Trade; and they are placing their own free and easy interpretation upon that of the Board of Trade.

The President of the Institution of Gas Engineers (Mr. John Young) has promptly communicated with Mr. C. F. Marwood, of the Board of Trade, calling attention to the fact that coalowners are interpreting the correspondence to simply mean that they have the right to take as the basis price, in all cases, the highest rate obtained from any purchaser for similar quantities. It is obvious that, if the Act was intended to be of real value by establishing fixed principles upon which to proceed, there was originally no intention that such looseness should prevail. Either adventitious or temporary circumstances may have caused some buyer near the corresponding date of the prescribed year to pay a high price for a similar quantity of coal of the same description; and to expect another buyer to have this exceptional price taken as a basis would virtually mean that the 4s. standard would be raised, and that he would, in all probability, be paying in excess of what other buyers who were fortunate in not making a new purchase near that date were called upon to pay. Acts of Parliament are not especially designed to inflict injustices, when, under such circumstances as are here referred to, they can be possibly avoided. "It "is felt," says Mr. Young in his letter to Mr. Marwood, "that the only way"—we would say, the only fair way—"of giving real effect to the Act, and limiting the "increased price of 4s. over the average, is that the price "paid by an individual purchaser shall be compared for "the purposes of the Act with the previous prices paid "by the same purchaser, provided a purchase has been "made. Otherwise, by taking as the basis price the "highest price obtained, the buyer would be heavily "penalized." The reply from the Board is very indefinite; and it only accentuates the flexibility of the provision as to the basis price. The letter appears to try to console the buyer over the uncertainty in which he now finds himself. "Don't worry; it is more likely than not that the buyer's "own purchase in the prescribed year is the one that will, "through similar conditions, govern the new sale, than the "sale to another buyer." That is the effect of the reply; and it is very unsatisfactory. We can see dispute upon dispute arising; and the Board, we are much afraid, will find that they will be kept very busy through their good-natured willingness "to offer an opinion on any case that may be "referred to them by the parties."

The Board also express the pious hope that buyers and sellers will be ready to interpret the Act reasonably, and not require reference to contracts under which the price is either unusually high or unusually low, owing to special temporary circumstances which may have existed at the time. We wonder what the Board think was the object of Sir T. Ratcliffe-Ellis in communicating with them on the subject. And if the Board are under the impression that charitableness resides among the coalowners as a prominent virtue in connection with coal sales, we would ask them to re-read the "Report of the Committee appointed by the "Board of Trade to inquire into the Causes of the Present "Rise in the Retail Price of Coal Sold for Domestic Use." When there is talk of reasonableness in connection with the fixing of coal prices, there is some doubt as to whether, in the multitude of matters the Board have had to deal with of late, the contents of this report have not escaped their memory.

Promoting the Technical Efficiency of District Associations.

THERE was no occasion for Mr. C. H. Webb, of Stourbridge, to apologize to the members of the Midland Association for the character of his Presidential Address, owing to the pressure there has of late been upon his time. We have both listened to and read the address with great interest. Some Presidential Addresses are composed of so much that is commonplace, and merely a reiteration of statements that have been "done to death," that it is always something for which to be thankful when an address comes constituted of jottings of original thought, and embodying experiences with the materializations of the writer's own views as to details of technical working and commercial methods. Mr. Webb's address is so constituted, and thus the freshness and the interest that are found in it.

Right at the opening of the address, we are confronted with a question of District Association policy. We have never heard there is any general feeling that the number of meetings normally held by the District Associations is insufficient for realizing the best efficiency from them. But Mr. Webb appears to think the number is short of requirement. The question is worth discussing from all points of view; and the President, we are sure, could welcome the *pros* and *cons*, through our columns, of colleagues who are interested in the question of enhancing the usefulness of the Associations to the profession. He takes the Midland Association as typical; and he does not see that two meetings a year for the consideration of technical and other subjects are sufficient to give full effect to the object for which the organization was formed—that is to say, to promote the advancement of the gas industry in all or any of its branches. In the case of the Midland Association, there is a third, or May, meeting, usually devoted to a visit to some works "when no technical business is transacted." "This means," says the President, "that on only two occa-"sions per annum do we discuss matters relating to the "industry." We would entirely dissent from that. If Mr. Webb had inserted "formally" before the word "discuss," he would have disarmed one from making the point that visits to works are technically to professional gas men most educative; and the opportunities so given for chatting over what is seen with colleagues—some of whom rarely open their mouths at meetings where there is formal discussion—are most informative. The visits are not only valuable through the conversational discussion, but, as a rule, the varied conditions of works are rich in object-lessons, which may at some time or other be turned to good account. We are not disposed to eliminate visits to works from the technical value of District Association proceedings.

It is agreed that the components of the work falling to the lot of the professional gas man are many and varied, and that the subjects to be investigated and discussed are more than can be undertaken at only two meetings—if two meetings of gas engineers were the sum-total of those held in a year, if there were only one Association, and were there no means available of disseminating reports of discussions on the great diversity of topics, and of contributing (through print) the personal information which is possessed by those who do not take part in the discussions. However, Mr. Webb's considered view is that the Association should hold more meetings; and that there should be a new way of dealing with subject-matter. In other words, on the latter point, he believes that short communications or collections of notes would be much more effective than the lengthy papers usually provided in producing interesting and useful discussions. The one thing bears upon the other; the question of contributions bears upon that of the number of meetings. We are believers ourselves in the efficacy of short communications and collections of notes as promoters of discussions; but on what ground, other than increasing the number of topics dealt with, does Mr. Webb advocate them? Here is his answer: "The preparation of a long "paper is a matter involving great expenditure of time "and labour . . . and the onerous nature of our duties "prevents us from giving up the time required in prepara"tion." Then, again, at the end of the address, he remarks: "I have had very little spare time during the past few "months to devote to the preparation of this address." Admittedly, the duties of gas engineers and managers have been of an exigent character during the past few months; but from what the President says in regard to the question of papers, their preparation is largely a question of want of time—"the onerous nature of our duties" (let us repeat his words) "prevents us from giving up the time required for "preparation." If time cannot be spared for the preparation of papers, can time be spared for attending more meetings? Answer depends on individual circumstances. But, speaking generally, meetings normally claim a large share (variously, of course) of the attention of members of the gas profession. There is the annual meeting of the Institution of Gas Engineers; there are the District Association meetings (some gas engineers are members of two and three such Associations), there are the meetings of Commercial Sections, there are the meetings of the British Commercial Gas Association, and the annual meetings of the Gas Companies' Protection Association and the Sulphate of Ammonia Association. There are in addition for several engineers Council meetings and Committee meetings. The claims on time by these various organizations are necessary, but they are also already great; and therefore it becomes a question whether gas engineers could really afford to have numerically enlarged their engagements for technical and commercial meetings. We think not, and that the present engagements would suffer by the greater diffusion.

Before there is contemplation of an increase in the number of Association meetings, would it not be better to consider the question whether the efficiency of those already held could not be improved? In our opinion, there is no lack of platforms at the present time for all necessary discussion if the best use be made of the time, and if members of the organizations would themselves do each his part in promoting maximum usefulness. The members of the Midland Association will not perhaps mind a little plain speaking. At some of their meetings in recent years, there has been observed a perceptible falling-off in the attendance of members. What has been the cause of this? Is it due to the Association not having consistently lived up to the standard of the past? Is it due to the quality of the papers not having consistently been up to that of bygone times? There should be introspection before attempting to increase obligations by holding additional meetings. The value of the meetings already held should be by some means—whether by those suggested by the President, or in other ways, is a matter for determination—first enhanced; and this alone, without increasing the number of meetings, is worth the very serious consideration of the members.

As to contributions to inaugurate discussions, the idea of Mr. Webb regarding shorter papers and notes is good. The proposal should first of all be generally tried at the next few ordinary meetings. If some topic were selected well beforehand, several members might contribute their experiences regarding it in the form of prepared short notes, which would likely contain more information than many of the extempore utterances that at present pass for contributions to discussions at some of the technical meetings. There is another method of realizing proper discussions of current topics, and that is when a particularly appropriate paper is read at an Institution meeting, or at a meeting of any one of the District Associations, for that paper to be utilized as the basis of discussion at the meetings of all the District Associations. This is done by the District Sections of the Institution of Electrical Engineers; and, by this practice, views and experiences on the topic are secured from different quarters of the profession, and duly placed on record. We are confident there is much that might be done to raise the usefulness and efficiency of our District Association meetings. It is so easy to fall away from past standards that are good; the difficulty of maintaining the standards is great. The reason is that, in Association work, there is nothing in the way of personal concrete obligation, the same as there is in regard to the duties of a remunerated office. Members are not all fully alive to the obligations that they take upon themselves by membership; and this want of appreciation is the bugbear of an honorary secretary's life. To add to an honorary secretary's anxieties by an increase in the number of meetings, and the labour involved by every meeting—well, may it be forbidden, until the utmost is made of the meetings that are provided for by the existing rules.

The President also dealt with many works and commercial topics; and his experiences, views, and suggestions will be found of a highly practical and useful nature. But the subject to which he gave first place in his address is the one that suggested comment; and so, with a word of commendation to consideration of the remaining topics, we must leave what must be regarded as an eminently appropriate deliverance from the occupant of the Midland presidential chair.

Washing with Oil for Benzol and Toluol.

The country and her Allies need benzol as well as toluol; and it happens that British gas undertakings and coke-oven plants are in a superior position to those of any of the Allied countries for producing and delivering these necessaries in the largest volume. France has been deprived of the services of the chief coke-oven plants in Flanders; and unfortunately her loss is Germany's gain. France must not suffer from this cause, while this country is in a position to alleviate her loss. The appeal for the production of more benzol was reiterated, at the meeting of the Midland Association of Gas Engineers and Managers last Thursday, by Mr. John Bond, of Southport, who has taken an excellent part in the operations of the High Explosives Department not only by word of mouth, but by actual work and example at Southport. He told the members of the Association that the position in regard to toluol, through the application of the "C" process, is most satisfactory, and that about 25 per cent. of the toluol content of gas is being extracted at the present time. But there is the requirement for benzol; and this is what he attended the meeting chiefly to talk about, in order to stimulate interest in the matter, and to give information as to the simple method that he has applied at Southport so as, with the hearty support of his Committee and the Corporation, to do his share in assisting in providing benzol. On the same occasion Mr. Hubert Pooley, of Leicester, supplied particulars as to his working experiences in benzol extraction with green oil, in one section of the Aylestone Road Gas-Works. But Mr. Pooley was there to give information, and not to advise—though he had obtained remarkable benzol and toluol results—that green-oil washing should be generally adopted. Green oil is difficult to get in large quantities; there is no money in its use; the effect on the illuminating power and the calorific value of the gas is disastrous, and, in consequence, he has had to compensate for this by the aid of his carburetted water-gas plant, and by reducing the make of gas per ton of coal in another section of the works. Both of these compensating processes mean money with oil and coal at current high prices.

At Southport, on the other hand, American gas oil is being used. Although the oil is expensive, benzol is a necessity; and it all depends on the price secured for this whether the process pays. Mr. Bond obtains 8½d. per gallon for the crude benzol. As will be remarked from the diagram published elsewhere in this issue, the plant required is of a very simple character; and at Southport old apparatus has been largely utilized. The method of circulating the oil is described in the report of Mr. Bond's remarks; and the work it will be seen has to be done in a systematic manner or there is a considerable loss in benzol recovery. The oil is circulated at the rate of 6 gallons per 1000 cubic feet of gas for six hours, from which time there is a falling-off in the extraction of benzol and toluol. Heating the oil, by the aid of a Wilton's dehydrating coil and a steam-jet, to a temperature of 110° C., the whole of the crude benzol is recovered from the oil. There is comparatively little loss of oil in the process. Up to the present no depreciation in the efficiency of the oil has been observed. When, if ever, it becomes spent, Mr. Bond is proposing to try the effect of using it in the carburetted water-gas plant. Another point of interest is that the oil takes up a considerable quantity of naphthalene; and since the process has been in use, only about 5 grains of naphthalene per 100 cubic feet of gas has been found at the inlet of the purifiers. Mr. Bond's position in this respect will be envied by many who are suffering from increased naphthalene trouble, to whatever cause it is attributable. But there is one point about the use of American gas oil upon which more information is desirable; and it is that the toluol extracted by it, according to the statement by Mr. E. W. Smith of the experiences at Nechells, contains too high a percentage of paraffins. This is a point to which Mr. Bond does not appear to have referred.

As to results, with the American gas oil process at Southport about 4 lbs. of benzol and toluol are extracted from the gas made per ton of coal. It has reached 6 lbs.; but the lower figure is about the normal one. With more drastic green oil treatment, Mr. Pooley recovered (according to the test of one sample of oil) 13·6 lbs. of benzene and 5·28 lbs. of toluene; and Dr. Colman's tests from the same sample showed 13 lbs. of benzene, and 3·9 lbs. of toluene—the discrepancy being partly accounted for by an irregularity in the thermometers. Over an extended period, Mr. Pooley obtained from the gas per ton of coal an average of 1·02 gallons of benzene, and 0·28 gallon of toluene, which are equal to 9 lbs. of benzene and 2·7 lbs. of toluene. These are high figures, and hence the effect on the illuminating and calorific power of the gas, which necessitated the utilization of carburetted water gas and the reduction of the make of coal gas per ton in another section, in order to build-up the impoverished gas. But at Southport, with a recovery of 4 lbs. of benzol and toluol, the illuminating power was reduced from 16 to 13½ candles and the calorific value from 530 to 490 B.Th.U. net. This is a gas of which no consumer utilizing it in proper ways can complain.

Southport has gone to considerable expense in this matter of helping the country; and those in authority in the Gas Department there, under the advice of Mr. Bond, have no intention, statutory prescriptions notwithstanding, to retrace their steps after the war. The country has had need of the services of the department; and those services have proved the sufficiency of the gas that is now being supplied. Following the war, the interests of the country will best be served by the availability of all the products in large quantities that the washing of gas by oil will provide. The war has put every gas undertaking into the position of being a concern not only of local importance, but of national importance. Every undertaking has had disclosed to it through the war a larger sphere of usefulness, not only in connection with the provision of materials for explosives making, but in connection with dyes and motor fuel. And, as we were recently remarking, the war is providing the evidence to lay before Parliament that the time has come when greater liberty in respect of gas supply will be to the best possible advantage of the general interests. Those gas engineers who fear the inroads of electricity through any interference with conventional qualities are simply rejecting the realization of the weapon that will give them larger competitive power in the future.

For the meeting, Mr. George Stevenson, of Long Eaton, had prepared a paper on "Toluol and the Limestone "Process." But time was against its adequate discussion. Therefore it was decided to have the paper published; and there will probably be discussion upon it at a meeting in May, which will, owing to current conditions, take the place of the usual visit, which would, under ordinary circumstances, have been to Stourbridge. The pleasure of the visit there, it should be said, is only deferred, and not annulled by current conditions. It will be observed from Mr. Stevenson's paper that, after the adoption of the limestone process, tests of the tar showed that the yield in pounds of toluene and benzene considerably improved per ton of coal carbonized. Samples of coke also showed but a faint splash of white here and there on the surface, owing to the use of the limestone, but there were no internal indications of it. This is due to the limestone being applied finely ground, and not in coarse form. If it were in the latter condition, the indications would be stronger. The point that has therefore been made, that the coke is depreciated in appearance by the limestone, is not confirmed by these samples.

In the Interests of Coke Producers.

The Engineer and Fuel Expert of the London Coke Sales Committee (Mr. E. W. L. Nicol) has previously proved himself so adept in the art of imparting interest to even such a superficially dull subject as coke, that it is unnecessary to refer to this quality of the paper that he read before the London and Southern District Junior Gas Association on Friday evening last. The paper possessed two other qualities. One was that it was highly instructive, and the other that it was excellent in suggestiveness. The juniors of the gas industry require instruction from one who is (so to speak) "in the swim" in all the matters appertaining to fuel characteristics and requirements in connection with steam-raising. We are not disposed to hide the truth that, as fuel users, because they are fuel producers, the gas industry has been distinctly wasteful. It has largely improved its position in respect of fuel consumption for carbonization, through more scientific construction and methods of heating. But it has not yet done all in this particular direction that it might do by automatic regulation of the primary air supply to its retort-furnaces. In the boiler-houses, there is no real or noticeable attempt at fuel economy. There is the fuel; fresh supplies are taken, in most cases, just as they are wanted; and there the matter ends. More is the pity, because from the extensive use of coke breeze and dust on gas-works for steam-raising, a very large experience should have yielded invaluable data for employment in the campaign for extending the utilization of coke for steam-raising in the industries generally. Fuel waste for this purpose extends to several other industries. Mr. Nicol pointed out to the Southern Juniors several places where there is to be found the defect of uneconomy, and where old errors are perpetuated in the purchase of boiler fuel; also why thermal units are not the only factor to be taken into account in assessing the value of a fuel, but fixed and volatile hydrocarbons should not be ignored, and how it is that gas coke has merits for industrial purposes that are not appreciated as they ought to have been.

Whose fault is this? It is largely that of the gas industry, through for generations marketing coke without any care as to the uses to which it is put, and without any heed as to whether efficiency or the contrary governed its employment, or whether it was supplied in the best form for application. It was then considered to be no business of the gas industry to do anything other than get rid of the coke to the best possible monetary advantage. For this heedlessness, the coke market was suffering acutely before the war started; to this heedlessness is due the birth of the London Coke Sales Committee, and the appointment of Mr. Nicol as their expert. These are two happenings for which we feel under an obligation to the heedlessness—nothing more. But the time has come when producers of coke—the gas industry and the coke-oven industry—must do more than they have done in the past to develop their markets. Gas coke is doing well now; but sight must not be lost of the fact that clear coke yards are due to the war, and to the shortage of available fuel owing to the state of labour at the coal mines. The times are coming when these favourable conditions for coke will be altered. Fuel economy, too, is being preached up and down the country; and coke producers must have a care that, if anything definite in the way of fuel control comes along, they have established a right to be heard, to take part in, and to benefit from, anything that is done. They must look to it that their interests do not go astray or be overlooked through any indulgence of the sense of a present security.

Now Mr. Nicol makes a suggestion by which coke could better establish its position in the industries. Steam-raising supplies a large outlet for coke; but, to efficiently utilize it for the purpose, it is necessary that certain inexpensive appliances should be developed. It is pointed out by Mr. Nicol that the relatively high cost of forced-draught apparatus necessary to burn coke at a high temperature is largely responsible for the comparatively limited market and, in relation to its thermal value, poor prices realized for coke in the past. Coke producers ought not to be content to let things remain as they are; they ought not to be content to let the improvement of the status of coke as a fuel in industry rest upon individual enterprise in attempting to develop cheaper and more efficient appliances; and they ought not to leave the collection of data to anyone who chooses to collect, and who probably has very ill-defined information as to the conditions under which the data are secured. Systematized work in apparatus development and testing, and data collection, is necessary to the future of the coke market; and Mr. Nicol holds that this should be a matter for conjoint effort and financing between the gas and coke-oven industries. Sulphate of ammonia has its Association, and is financed by the producers for commercial purposes. There is, however, something more than trading watchfulness required in connection with coke. It has an important technical side, the interests of which will always be neglected unless some such scheme is adopted as that which is now adumbrated. The financing is the most difficult part; with money at hand for the purposes in view, the rest would be quite easy.

Mr. Nicol is suggesting that a modest subscription of 1s. per 100 tons of coal carbonized by the gas and coke-oven concerns interested would form the nucleus of a fund to provide the necessary means and incentive to inventors in this direction. "Without effort and incentive of this de-"scription, the use of surplus oven and gas coke may con-"tinue to be more or less limited to low-temperature appa-"ratus." The money side of the suggestion is admittedly modest, looked at from the shilling per 100 tons point of view, and not from that of the total. We do not believe in parsimony in such matters; but we think that the subscription might be still more modest, and yet effect what the proposer has in view. Some 36 million tons of coal are carbonized by the gas and coke-oven industries in a year; and the yield of 1s. per 100 tons would be £18,000. We cannot imagine this sum would be needed annually. It is a large amount; and with such a yearly income, the two industries might almost set about fitting up forced-draught apparatus to boilers free. With £18,000 a year, if there were no other claims on the money, 2850 furnaces could be equipped with apparatus at £6 6s. each. However, Mr. Nicol's scheme is one which should be very seriously considered, for it is really modest, and its potentialities are far-reaching.

What of the Institution of Gas Engineers?

It is a singular thing that, no matter what is being done of a public nature in which scientific and technical societies are concerned, the name of the Institution of Gas Engineers rarely figures. Yet if the Government wants high explosives, acids, and other chemicals, the gas industry is applied to, and urged to do its best to supply, and so show its patriotism. Even at a time when it is straining the constitution of its prime commodity to assist the country, and just when it ought to be recognized more than ever as one of the great indispensable industries of the country, it is bye-passed, and no regard is paid to it. Its productions, too, supply to various other industries their raw material, over which a great deal of scientific energy is expended. But who cares? When there is talk of organizing science, and when the Royal Society calls a meeting to consider the establishing of a conjoint board of scientific societies for the purpose of organizing scientific effort in the country, all the other principal technical and scientific societies appear in the published report as having been represented, but search is made in vain for the name of the Institution of Gas Engineers. Yet the meeting considered that a conjoint board was required to promote the co-opeation of those interested in pure and applied science. The gas industry is much interested in applied science. It is also interested in the "means by which the scientific opinion of the country may on matters relating to science, industry, and education find effective expression." It is also concerned in "taking such action as may be necessary to promote the application of science to our industries and to the service of the nation." Yet, we repeat, it is not stated in the report of the meeting that the gas industry was represented. The Institution of Electrical Engineers was. A Committee has been appointed to draft a scheme for giving effect to the resolution, and to report at a future meeting. There are several "Fellows of the Royal Society" identified with the gas industry. Therefore, if the existence of the industry has been forgotten, and thus representation not invited, perhaps the matter can still be adjusted.

Australian Gas Undertakings.

As might have been expected, the gas industry in Australia is finding itself confronted with some of the same difficulties as have, on this side, contributed to give directors, committee men, and officials an exceedingly trying time. In Melbourne, for instance, there have been higher prices for coal, increases in wages, and an enhancement of the cost of all material required for repairs or use at the works, or for distribution purposes. Freight charges are naturally disagreeably high. But business still goes ahead, an increase of close upon 8 per cent. being reported in the sale of gas during the past twelve months, as compared with 1914. The percentage increase of the consumption, too, was more than twice that of the number of meters fixed—an important consideration from the profit point of view. In the case of Sydney, it was stated at the half-yearly meeting that the Australian Gaslight Company had experienced a slight decrease in the consumption of gas, though there was a substantial increase in the number of consumers. In addition to the unavoidable cares, the Company were called upon to devote attention to an inquiry into the price of gas by the Necessary Commodities Control Commission. This inquiry the Board naturally regarded as somewhat inopportune; their opinion being that when the war is finished will be plenty of time for the Commission to think of revising their previous decision on the subject. Another matter calling for special attention was an application by the men (on the expiration of their agreement with the Company) to the Wages Board for a new agreement and an award. Lastly, there was the claim against the Government for compensation in respect of certain property taken over. This has been settled, after hard work on the part of the staff, which was warmly acknowledged by the Chairman. Readers will notice one point of similarity in the reports of the proceedings at the meetings of the two Companies, and that is the testimony they bear to the noble manner in which the employees have come forward at the call of duty.

Salty Coals and Refractory Materials.

Before the Coke-Oven Managers' Association last Saturday, Professor John W. Cobb discussed the effect of salty coals upon the walls of coke-ovens, and, of course, what he had to say applies equally to other coal-carbonizing structures composed of fire-clay material. The paper was more theoretical and directive than conclusive; and Professor Cobb would have what he puts forward taken as a basis from which manufacturers of fire-clay material should make further investigation and practical experiment. In dealing with the interaction that occurs between the volatilized salt and the fire-clay walls which has such disastrous effect, he dismissed the assumption that the action, or even the repeated action of sodium chloride on the surface of fire-clay has necessarily any very detrimental effects. There would be comparative immunity from destruction if the salt vapour could be kept from contact with the fire-clay face until the temperature of this was so high—say 1200° C.—that any compound formed was in a state of fusion. If sodium chloride is allowed contact at temperatures below this, the result is quite different, and much more serious. What, in Professor Cobb's opinion, happens is this: At a comparatively low temperature, the salt in the atmosphere of coal gas volatilizes, and, penetrating into the brickwork, combines with its substance. In so doing, it alters physically and chemically the composition of the portion of the wall nearest the face. The temperature of the brickwork is lowest near the face, highest near the combustion flues, and rises gradually from one to the other. Near the face the temperature is not sufficiently high to fuse the soda alumina silica compounds formed there. But these compounds have also formed further in, where a point is reached where the temperature is high enough to effect fusion—to produce liquidity, porosity, honeycombing, and rottenness of structure, making for disintegration. As a consequence of the chemical alteration in the portion of the fire-brick into which the salt vapour has penetrated, there is an accompanying physical change in the co-efficient of expansion which may have considerable influence. If the outer layer is expanding and contracting every time the oven is heated and cooled, to an appreciably different extent from the substance at the back of it, this is, in itself, a disintegrating force.

Suggestions.

Professor Cobb does not put forward any remedy, but indicates the lines on which a cure could possibly be effected. It is obviously advisable to minimize the amount of penetration through the face by the use of practically non-porous material. But complete exclusion can hardly be hoped for. To realize this, the face should be close-grained, and the face and sizes so exact as to allow the use of small joints. Then the substance should be of a composition physically and chemically best adapted to resist the fluxing action of the salt. Free silica in the brick requires special consideration, because it may act in directly opposite ways. If it is very finely divided, so as to bring it into effective contact with the clay material, the silicate of alumina fluxing is enhanced. If, on the other hand, the silica grains are large, the fluxing action of the salt is confined largely to their exterior, and a state of affairs is readily attained in which the clay and fine silica, attacked by the salt, have formed a pasty mass, stiffened and strengthened by the silica grains. The beneficial effect of large-grained silica is due to the minimizing of its interaction with the other material present, which can only take place upon the interfaces of particles.

Lighting Glassware Shortage.

The war has turned glassware for lighting purposes, which was at one time considered in the gas industry chiefly from the commercial and æsthetic points of view, into a pressing problem. Supplies were always plentiful at one time, and the range of patterns from which to make selection one to which no exception could possibly be taken. Thanks for these conditions were almost entirely due to what are now enemy countries, and not to the enterprise of our own manufacturers. Glassware for the lighting industry—the gas industry requires annually an immense amount of glass of good heat-resisting quality—is one of the country's missed opportunities. But glassmakers at home are now doing their best, under the restrictions of current circumstances, to put something into the "aching void" from which the lighting industries are now suffering; and it is hoped that time will enable them to do more and more, until the country is practically self-reliant in this respect. The difficulties of the situation are such that the Illuminating Engineering Society last Tuesday descended from its scientific platform to consider British glassware manufacturing conditions; and those conditions, as a result of the discussion, are seen to be hopeful, if not exactly brilliantly so. The discussion was raised on a paper by Mr. S. B. Langlands, from which, together with the speeches, it was made abundantly clear that, if the lighting industry is to be self-supporting in respect of lighting glassware, then it is necessary that there should be co-operation between manufacturers and buyers, through organized means, instead of the isolation of the one from the other which now exists. [Unfortunately, our report of the proceedings is crowded out this week.]

Need and Standardization.

The manufacturers do not seem to know precisely what the lighting industry wants; and the lighting industry has taken no positive steps to inform them, beyond piling on them such a mountain of designs and an almost innumerable assortment of shapes and sizes that the manufacturers simply stand aghast, and very properly ask whether something cannot be done, under the circumstances of the want of a sufficiency of plant, skilled labour, &c., in the way of the regulation of requirement. Mr. Langlands is strong on standardization. Standardization in some ways would be good, but only in others as a temporary expedient. For instance, there has been such a variety of pattern at command in the past, that it is hoped the condition will not be permanently withdrawn, but will be, within reason, re-established in time by our own manufacturers. If not, there can only be one result later on. If, however, makers of burners would standardize their productions so as to reduce the number of sizes of globes, glasses, &c., required, this would be a decided advantage. As to the chemical composition of glass, we hope the manufacturers will themselves ascertain the best standard for high temperature work, and then live up to it; and if further research shows that the hitherto "best" is capable of being exceeded, then it will only mean that a fresh standard has been established, and for it there will be thankfulness. There are many points in the paper and discussion which will interest readers in regard to this pressing matter, in which shortage and high prices have wakened a new and lively interest.

EDWARD ALLEN, JUNIOR.

Much sympathy will be extended by the gas industry to Mrs. Allen and family, in the death of the eldest son, Edward, which occurred at his residence in Bootle early last Sunday week, after only a few days' illness from pneumonia, at the early age of 38.

Mr. Allen, junior, had been identified with the Liverpool Gas Company for many years; for it was in their works, shops, and drawing office that he received his training, after having been educated at the Birkenhead Institute. He entered apprenticeship with the Company in 1894; and was appointed Junior Draughtsman in 1899, and Chief Draughtsman in 1904. Valuable experience was gained by him in the latter capacity, in connection with the extensive additions and alterations to the works and plant of the Company carried out during recent years. In the changes consequent on his father's death, he was appointed Superintendent at the Company's Linacre works, a position for which his all-round capability well qualified him. In fact, he could fill the Superintendent's position in any department of the Company at short notice, which he was at times called upon to do. Holding himself a number of certificates in technical subjects, he had for the last two years filled with considerable success the position of Lecturer in "Gas Supply" under the Liverpool Education Committee. In 1914, he was admitted a member of the Institution of Gas Engineers.

Although of a quiet and retiring disposition, Mr. Allen was a great favourite with the staff—possessing a courteous and pleasing manner, and being ever ready to assist his colleagues and cooperate with them in all good works. A large circle of friends received the news of his death with very deep regret.

In a letter full of sympathy with the bereaved relatives, Mr. Edwin Upton, Treasurer of the Liverpool Gas Company, says: "At the funeral, the chief mourner was another Edward Allen—a little fellow of thirteen summers, whose childish dignity in a trying situation gives promise. His little soul had doubtless been stirred by a mother's anguish; and he had formed a resolution to be a man henceforward. Thus grief follows grief almost with tragedy; and a wife with four little ones—their ages are respectively thirteen, nine, four, and two years—are left to the cold winds of a chilly world. Yet there is the consolation to the looker-on, that from out these trials there rise some of the best of our manhood; and the writer has a strong faith that the great charity, bountiful deeds, and true benevolence of the grandfather of these little ones will not perish."

LIEUTENANT C. V. TOWNSEND.

Second Lieutenant C. V. Townsend, of the 7th King's Shropshire Light Infantry, was killed in action in France on Tuesday night, the 21st inst. He was 28 years of age, and single. In civil life, he was Engineer and Manager of the Hereford Corporation Gas-Works. Lieutenant Townsend was the second son of Mr. Henry Townsend, Managing-Director of the Wakefield Gaslight Company. He was educated at the Wakefield Grammar School, and having served his articles to his father was for a short period Draughtsman to Messrs. Drakes Limited, Gas Engineers, of Halifax, and then for some years Assistant Engineer and Manager to the Wakefield Gaslight Company, leaving at Christmas, 1913, to succeed his elder brother as Engineer and Manager at Hereford. Upon the outbreak of the war, having had four years' training in the 4th K.O.Y.L.I. Territorial Force, which he left with the rank of Sergeant, he considered it his duty to offer his services to his country, and enlisted in the Grenadier Guards. He served six months in the ranks, from which he was given a Commission in the 7th K.S.L.I.

Two of his brother officers have sent particulars of his death. Second Lieutenant L. M. Dell says Lieutenant Townsend was in charge of a small patrol, who left the trenches about 10 at night to have a look about. They crawled round the German wire for some 100 yards, and got back safely to their own wire, when a grenade suddenly exploded, killing Lieutenant Townsend. He lived about ten minutes, but was not conscious. Stretcher bearers were got out of the trench in a couple of minutes, and everything was done that was possible; but he had no chance. He was hit in the head. One of his feats was to cut a section of German barbed wire out of their defences, and bring it home. It was sent to Army Headquarters; and the Division wrote thanking the regiment for the information obtained. He had always been the leader of all the patrols; and his men had done more damage to the "Huns," and got more intelligence, than all the rest put together. He was always a very careful man, with no nerves at all; and as far as could be seen not the slightest fear. He was known as absolutely the coolest man in the Battalion. Everyone in the Battalion always counted him as its best officer for any dangerous work. Second Lieutenant A. W. Johns says: "Whenever any patrolling had to be done, both of us nearly always went out together; and I was never in fear so long as he was with us, because he gave me such confidence that I knew we would always come out on top when we met an enemy patrol. He was very popular with all of us, and an excellent officer in every way."

We heard yesterday afternoon from Mr. Townsend that he had received a letter from Lieutenant-Colonel R. E. Negus, the Commanding Officer of the Battalion, stating that Lieutenant Townsend was shot while patrolling on the night of March 21, and survived a few minutes only. The writer adds: "He was one of the bravest men I have met, and had performed such splendid services in obtaining information and in inflicting loss on the enemy, that I submitted his name recently for mention in despatches. He was universally popular with the officers and men, and cannot be replaced. Will you please accept on behalf of the Battalion our most profound sympathy. I am attending his burial, and representing the regiment."

PERSONAL.

We learn that Mr. Harry E. Jones has been elected a Vice-President of the Institution of Civil Engineers.

Mr. A. M'Alpine, of Aberfeldy, has been appointed Manager of the Pitlochry Gas-Works, in place of Mr. J. Letham, who is now Manager of the gas-works at Leslie.

Mr. Ralph Halkett, the Commercial Superintendent of the Glasgow Corporation Gas Department, has accepted the post of Honorary Examiner in Gas Supply for the Royal Technical College of Glasgow—a new post necessitated by the formation of classes in "Gas Supply."

The Cowes Urban District Council received 103 applications for the vacant managership of the gas-works (caused by the death of Mr. E. H. Millard). After interviewing three candidates, Mr. Henry Butterfield, the Manager of the Swadlincote District Council's Gas-Works, was appointed.

Mr. C. M. Wilson, the Chief Assistant of Mr. R. W. Edwards, the General Manager of the Aldershot Gas, Water, and District Lighting Company, has accepted a Commission as Lieutenant in the Army Ordnance Corps, Inspector of Machinery; and Mr. A. Vincent Barraclough has been appointed his successor.

Chief Petty Officer W. J. Liberty, Public Lighting Inspector to the City of London, of Lord Fisher's Department (Board of Invention and Research), has been rated-up by the Admiralty from the Royal Naval Volunteer Reserve to the Royal Naval Air Service, and transferred to the Admiralty Air Department, under Admiral C. L. Vaughan Lee.

A special meeting of the Executive Committee of the Canadian Gas Association was held in Toronto on Feb. 19, at which the resignation of Mr. John Keillor as Secretary-Treasurer was accepted, and Mr. George W. Allen, of the Toronto Consumers' Gas Company, was appointed to succeed him. Mr. Keillor was to have left Hamilton (Ontario) early this month to take up the position of Superintendent of the Vancouver Gas Company.

Some New Committees.

The creation of further Committees, entrusted with various tasks, was announced during the past week. In the first place, it was intimated that the President of the Board of Trade had decided to appoint Committees to consider the position of certain important British industries after the war—especially in relation to international competition—and to report what measures (if any) are necessary or desirable in order to safeguard that position. So far, two of these Committees have been constituted. One is for the iron, steel, and engineering industries, with Sir Clarendon Hyde as Chairman, and Sir Hallewell Rogers one of the members. The other is for the shipping and shipbuilding industries, with Sir A. A. Booth, Bart., as Chairman. The constitution of a Committee for the textile industries is to be announced shortly. Then the Advisory Council for Scientific and Industrial Research announce that, in order that they may be in a position to do justice to the industries concerned in proposed researches submitted to them, it has been decided to appoint Standing Committees of Experts. Committees in Mining and Metallurgy have already been formed—each with two sections. Sir William Garforth has accepted the chairmanship of the Mining Committee and the Non-Metals Section; and Mr. Edgar Taylor will be Chairman of the Metals Section. The Metallurgy Committee will have as Chairman of the Committee and of the Non-Ferrous Section Sir Gerard Muntz, Bart.; and of the Ferrous Section, Sir Robert Hadfield, F.R.S. A similar Committee for engineeing is in contemplation. Grants are being made to various technical institutions, to enable them to continue researches already in progress. One branch of the Advisory Council's work is to train an adequate supply of research workers.

RESERVATION OF ESSENTIAL MEN.

The Present Position Explained.

The application made, on behalf of the gas industry, to the Board of Trade Committee on Reserved Occupations has been considered by that Committee, who have heard in its support representatives of the Institution of Gas Engineers, of the British Commercial Gas Association, and of the Society of British Gas Industries.

The Committee, which in view of the urgent need for more recruits is being pressed by the Government to revise quickly and thoroughly the list of "Reserved Occupations" in the direction of limiting, rather than widening, the present exemptions, showed itself, and undoubtedly remains, very averse from altering the wording respecting gas-works in the latest list. At the same time, its members recognize the importance of maintaining the output of gas.

To this end, they, at their last revision, included in the list of men engaged in "Reserved Occupations" all workmen inside gas-works (relying with good reason upon the patriotism of gas managers for the release of every fit man of military age inside the works who could possibly be spared or replaced temporarily), and hoped, as they were given to understand, that, with this concession granted, the industry would be able to manage to keep the outside work going by boys, women, and over-age men.

The Committee, however, pointed out in discussion in regard to outdoor men, the important fact that under the "General Exemptions in All Industries" are included:

> "Mechanics, &c.:—
>
> (2) Other mechanics and similar men engaged in the maintenance and repair of plant, machinery, and tools."

And they ruled that mechanics engaged in the maintenance and repair of gas mains and services (including those employed in removing naphthalene deposits) are covered by this general reservation. If therefore the Military Authorities will not agree to refrain from calling up a man so engaged, appeals could be made to Local Tribunals on those grounds, and carried to the County Appeal Tribunal if unsuccessful in the first instance. There is a further appeal (by leave of the County Appeal Tribunal) to the Central Authority in London. It might well be, and was argued, that maintenance and repair of plant in the case of a gas undertaking must include the maintenance and repair of meters, stoves, and other gas-consuming appliances; but the Committee would not endorse this interpretation of the general exemptions. The Committee pointed out, however, that it was open to any undertaking to appeal in respect of any man regarded as absolutely indispensable whatever his particular work might be.

In support of any appeal for indispensable outdoor men, it would, of course, be pointed out that in so far as the ingredients of high explosives (toluol and benzol) are produced as a bye-product of gas manufacture, the output thereof is necessarily strictly proportionate to the quantity of gas made, and that the manufacture of gas can only be maintained if the appliances necessary to its distribution and consumption are either kept in working order or replaced when worn out. The following statement made by Mr. Lloyd George on Nov. 9, 1915, as reported in the "Daily Chronicle," could be quoted in support of any appeal for an indispensable man whatever his grade.

> Mr. Lloyd George's New Difficulty.
>
> Too many Men Leaving Gas and Electricity Companies.
>
> The Minister desires to point out that such companies are engaged upon work of vital importance and that *the removal of their employees even to munition work may frequently have the effect of prejudicing the output of munitions of war.* He invites employers to assist him by refraining from attracting labour from these essential undertakings.

In regard to clerks, and others in administrative positions, who for particular reasons, are quite irreplaceable, the following extracts from the new "Instructions to Local and Appeal Tribunals" issued last Friday from the Local Government Board may be noted:

> (7) In deciding cases which come before them, tribunals should recognize the injury that may be done to the industries and commerce of this country if managers directing important businesses (including managing proprietors and managing directors), and clerks possessing technical knowledge, or otherwise occupying positions of special responsibility, are removed from their present employment and cannot be replaced. The same considerations will apply to the case of men who are the directing heads of farming and other agricultural operations. The number of men who come within these classes is comparatively small, but the loss to branches of industry and commerce which supply the sinews of war would cause damage to the economic welfare of the country out of all proportion to the gain to the Army.
>
> On this point the following suggestions are offered. The directing head of every considerable business of real national importance should be given exemption from military service. If there is more than one directing head, the tribunal should consider whether the business is of such a size or complexity that more than one head is essential. The tribunal will have to determine in doubtful cases whether any person claiming exemption is in a controlling position, and whether no efficient substitute can be found. In settling this question, the age of the applicant and the length of his experience in the business should be taken into

account. Thus, as a general rule, it may be assumed that men less than 30 years of age, particularly those with a small financial interest in the business, are not indispensable as directing heads. As regards small businesses, the tribunal must decide whether or not the claim for retention is reasonable.

In cases in which the time for appeal has lapsed, but the men have not yet joined the Colours, the time for appealing might reasonably be extended.

In dealing with these as with other cases, it is, of course, essential to bear in mind the urgent needs of the Army for men.

(8) Attention is also drawn to the case of responsible and directing clerks in certain establishments. Reference has previously been made to clerks in industrial establishments (see footnote to the list of certified occupations).* It has, however, been represented that the case of clerks in shipping offices, export houses, banks, insurance offices, and other large commercial establishments is somewhat different, as clerks here form a majority, or a large proportion, of the entire staffs.

In these cases it is very difficult for the military representatives, or the tribunals to arrive at a decision whether an individual clerk is really indispensable or not without technical knowledge of the businesses in question.

In the City of London, representative bodies concerned with great businesses, such as banks, have in various instances already been able to render valuable help by putting definite recommendations before the military representative based on a general survey of the whole field of their operations. Where this has been done, the task of the local tribunals is much simplified, and the establishment elsewhere, where possible, of the arrangements made in London is very desirable.

In presenting claims to the Local, the Appeal, or the Central Tribunal in respect of an absolutely indispensable man, it should be made clear that every possible effort has been made to find a substitute, and that every man on the works or the district or in the office that could possibly be spared—and not merely conveniently spared—had been allowed to enlist, and that women were being employed wherever possible.

Both by the Ministry of Munitions and by the Reserved Occupations Committee, the need for more men for the Army is plainly recognized as more than ever urgent; and every gas undertaking (in common now with every Government factory) has to be prepared to stand the most searching analysis of the men in its employment before it can get special assistance in retaining men of military age.

If, as the result of this new "winnowing" campaign, the gas industry finds itself threatened with so serious a handicap as would render it incapable of fulfilling its obligations both to the Ministry of Munitions and to the general public, further concerted action based on a volume of convincing evidence will have to be taken.

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* (2) *Clerks in Industrial Establishments.*—In most industries there are certain clerks who are indispensable on account of their technical knowledge, their intimate acquaintance with their employer's business or the managerial and directing character of their work. It is impossible to separate these men by classification from other clerks who can be replaced, as the distinction depends upon the circumstances of the individual case rather than upon the description of the occupation. Needful exemptions must therefore be left to the local tribunals, after consideration of each case on its merits.

PRICE OF COAL (LIMITATION) ACT.

Sir,—I am instructed to forward to you for publication the enclosed copy of correspondence which has passed between the Institution of Gas Engineers and the Board of Trade with reference to the recent correspondence between Sir Thomas Ratcliffe-Ellis and the Board of Trade, with regard to the interpretation of the Price of Coal (Limitation) Act.*

W. T. Dunn, Secretary,
Institution of Gas Engineers.

39, *Victoria Street, S.W., March* 21, 1916.

[Enclosures.]

Institution of Gas Engineers, 39, *Victoria Street, S.W.*,
March 17, 1916.

W. F. Marwood, Esq., C.B.,
Board of Trade, 7, Whitehall Place, S.W.

Sir,—The attention of the Institution of Gas Engineers has been called to the correspondence which has recently passed between you and Sir Thomas Ratcliffe-Ellis, as to the interpretation of the Price of Coal (Limitation) Act. It is found that the collieries are interpreting this correspondence to mean that they have the right to take as the basis price in all cases the highest price obtained from any purchaser for similar quantities.

This, it seems, cannot be the true intention of the Act; for it would mean that in all cases buyers would have to pay the price most advantageous to the colliery—the result being that the colliery would obtain considerably more than 4s. per ton on the average. Furthermore, it would mean that if there had been exceptional circumstances which would warrant the obtaining of a higher price in any particular case, all buyers of the same coal would forfeit, although the same circumstances would not necessarily apply to their cases.

It is felt that the only way of giving real effect to the Act, and limiting the increased price to 4s. over the average, is that the price paid by an individual purchaser shall be compared, for the purposes of the Act, with the previous prices paid by that same purchaser (provided a purchase has been made). Otherwise, as pointed out above, by taking as the basis price the highest price obtained, the buyer would be heavily penalized.

Awaiting the favour of your reply.

(Signed) John Young, President.

Board of Trade, London, S.W.,
March 20, 1916.

The President, Institution of Gas Engineers,
39, Victoria Street, S.W.

Sir,—In reply to your letter of the 17th of March, regarding the Price of Coal (Limitation) Act, I am directed by the Board of Trade to state that while, as pointed out in their letter to Sir T. R. Ratcliffe-Ellis to which you refer, there is nothing in section 1 (1) of the Act requiring that reference should in all cases be made to sales to the same buyer, such sales would probably as a rule be more likely to have been made under similar "conditions affecting the sale" than sales to other buyers.

The exact determination of the corresponding price may sometimes be difficult; and the Board hope that both buyers and sellers will be ready to interpret the Act reasonably, and not require reference to contracts under which the price was either unusually high or unusually low, owing to special temporary circumstances which may have existed at the time.

The Board are always willing to offer an opinion on any case that may be referred to them by the parties.

(Signed) W. F. Marwood.

ELECTRICITY SUPPLY MEMORANDA.

Wiring Rules Revision.

Judging from the criticism that at intervals appears in the Electrical Press, the Institution of Electrical Engineers cannot claim to be a perfect body. Its works, according to the critics, are always open to improvement; and the necessary improvement is frequently a difficult matter. Of course, we know that human effort rarely does attain an unassailable perfection. But the Institution of Electrical Engineers appears to be particularly unfortunate. Even its wiring rules, with the experience that has accrued since 1882, have never been brought to a condition that could be accepted as perfect. The Institution has realized this itself. Rules, of course, require modifying as fresh advances are made; but the old wiring rules are constantly being tinkered about, which shows that there has existed defect in some particular or other. This is unfortunate, because, if rules as formerly existing were not all they ought to have been, then work that has been carried out scrupulously according to the prescription will also not be all that it should be. The seventh edition of the rules has now been issued in revised and extended form. While the "Electrical Review" congratulates the Wiring Rules Committee upon its work, it says that, on the whole, the rules are not yet beyond criticism; but it believes the changes that have been made in the regulations are such as will command general approval. They do not all command the approval of the "Electrical Times." A broad smile covered the face of the reviewer in the latter as he alighted on some of the fresh decrees. "Electrical Engineering," too, does not think the Institution was well advised in issuing the new edition just at the present time. This contemporary, we rather fancy, is of opinion that with the current mind-absorbing topics, electrical contractors and manufacturers will not give themselves up to a full and thorough study of the regulations. It certainly requires vast mental power to keep all the rules and their periodical modifications and extensions within mind. It is interesting to learn from the "Review" that all the Fire Insurance Companies have now adopted the Institution's rules.

Changes—Gas-Fittings and Electric Wiring.

Preceding editions of the rules have dealt with pressures not exceeding 250 volts; the present edition also covers medium pressures between 250 and 650 volts, which change has been necessitated [quoting the "Review"] by the amount of power that is supplied from the outers of three-wire systems and on three-phase networks at pressures between 400 and 500 volts. We cannot here notice all the changes made; a few will suffice. Among the new clauses is one providing that, where medium pressures are used, adequate precautions must be taken, either by earthing or other means, to prevent any metal other than a conductor from becoming electrically charged. It is also observed that where energy is used for purposes additional to lighting, and where failure of light may cause panic or be "otherwise dangerous," the lighting must be controlled by independent main fuses. It is hoped that there will be loyal observance of another new prescription to the effect that gas-pipes must not touch conductors, or their insulating material, metallic sheathing, or conduit, whether earthed or not; non-conducting pieces being necessary to separate them. There has been a large amount of trouble through slovenly work across and contiguous to gas-piping. Then, again, it is provided that combined gas and electric light fittings are not to be used; and, if gas-fittings are adapted, they must be entirely disconnected from the gas-piping. On our part there is approval of these provisions. A clause that interdicted the use of dynamos, arc lamps, &c., in places where inflammable or explosive dust or gases are liable to exist has been modified by substituting mercury vapour for Nernst lamps. The facetious critic of the "Electrical Times" thinks this change may be due to patriotic motives. To the clause providing that metal conduits must be electrically and mechanically continuous throughout, there is now an addendum which explains that slip-joint conduits do not comply with this rule, but that some form of screw or grip joint is necessary to give ample and permanent electrical conductivity and rigidity throughout. For medium pressures, heavy gauge screwed conduits must be used. It is also recommended that conduit runs should be sloped to drainage positions.

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* The correspondence here referred to appeared in the issue of the "Journal" for March 7, p. 521.—Ed. J.G.L.

Heaters and Irons.

The "Electrical Times" appears to deplore that the word "cooking" does not appear in the rules; but it finds consolation in thinking that the word "heaters" has a meaning that embraces cookers. It is also shocked over the short-sightedness of the drafters of a new clause providing that heaters rated at above 1000 watts must be fitted with double-pole switches. "If this rule be enforced," remarks our contemporary, "it will involve redesign for every heater on the market, for we have never yet come across a heater so controlled. Electric fires taking 3, 4, and even 6 KW. are now being sold, and are controlled in sections by single-pole switches." If safety demands double-pole switches, then double-pole switches there must be; but our contemporary is apparently of opinion that this rule will be honoured more in the breach than in the observance. We do not doubt it; indifference and neglect are common failings in connection with electric installation. It is thought that a similar fate awaits a clause providing that red pilot lights should be used in conjunction with non-luminous heaters and heating appliances, such as smoothing-irons. It is doubted whether the domestic user of electric flat-irons would go to the trouble to utilize pilot-lamps in this way, seeing that the irons are frequently employed in living rooms, and are connected to the lighting supply, so that, it is submitted, it would be difficult to arrange for a pilot lamp for temporary connections of this nature. Whether this is so or not does not dispose of the fact that a pilot lamp is preferable. The rules form an interesting study, if only to prove that there are a thousand-and-one loopholes by which the vaunted "safety" of electricity can escape, and danger succeed it.

Economy or Luxury.

The British Electric Transformer Company are the makers of the "Tricity" cooker, about which much less has been heard since one named Grogan ceased flitting about the country in its interests. Anent it, a curious confession was made by Mr. A. F. Berry, at the recent meeting of shareholders; and it is that there is a division of view as to the merits of this type of cooker. He said that, at the moment, "Tricity" cookers were looked upon by some as an economy; while others regarded them as a luxury. It is strange that we have never personally come into contact with any independent person who has really looked upon the "Tricity" cooker as an economy. This is our old friend the "biscuit-tin" form of electric cooker; and it is known that, as compared with some of the other forms, this one takes longer to heat up to a given temperature, and it certainly parts with its heat quicker than the thick iron-cased and well-lagged types, which seem to be coming into general favour among electricians. The electricity supply industry has veered round to an acceptance of the experience of the gas industry; if electric cooking is going to make headway for domestic purposes, it must show not only good economy, but the appliances must be equal to the hard wear of kitchen life and method. On the two grounds alone of (despite its highly polished surfaces) heat efficiency and durability, the "Tricity" cooker is, published experiment declares, outstripped by other makes, unless, of course, the statement of Mr. Berry that the Company are improving their designs means that they have something of which we are not aware that threatens to have the two essentials of high efficiency and long life. Meanwhile, it is interesting to note that Mr. Berry realizes that some people regard the "Tricity" cooker as a luxury. It is singular that that happens to be the view we have entertained from the time we first saw one at work.

The Uncertainty of "Safety."

There is a beautiful uncertainty about the safety of electricity. The terms do not exactly fit; but it is a fact that, though the safety of electric current and operation is lauded, the safety only continues so long as there is no sudden, mysterious, or other interruption of the condition. This is all that can be said. Of course, in papers read before electrical and mining organizations, electric operation in mines has nothing to approach it. Mr. H. Elliott, the Engineer of the Frickley Colliery, near Barnsley, said so in a paper he recently read before the Yorkshire Branch of the Association of Electrical Mining Engineers; but in effect he had to admit that there are a good many loopholes through which serious trouble can come. Now the conditions of coal mines are notoriously favourable for very bad accidents; and electrical plant is notoriously susceptible to derangement in ways that readily contribute to disaster. When, therefore, electrical plant is introduced into coal mines, two extremes meet. It is stated by Mr. Elliott that, when accidents have been directly caused by electricity, they have been generally due either to the plant installed being unsuitable for its work, or to being badly installed and maintained. Warning permeates the author's words: "Electricity cannot be trifled with in a pit; and unless it is intended to instal a suitable plant to commence with, and to see that it is properly maintained, an electrical plant should not be installed at all." This means skilled and frequent inspection. Mr. Elliott emphasized the necessity of the employment of a fully qualified mining electrical engineer; and of a proper system of inspecting and testing plant.

An Example.

Not far away from the place at Barnsley where Mr. Elliott's services are in daily request is the Central Silkstone Colliery; and just about the time he was reading his paper, a number of summonses found their way to various persons officially engaged at the colliery. The charges referred to in the summonses covered a large field; and part of them dealt with the electrical appliances used in the pit. There is an electrician in charge of the appliances; but nevertheless there was trouble. An explosion took place on Oct. 17. When an electric coal-cutting machine was being started to work, there was a flash from it, with the result that four men were more or less seriously injured. When the summonses were being heard, Mr. James Mellors, an Inspector of Mines, stated that he had not the slightest doubt that the explosion was due to the ignition of gas by flame from the cutting-machine. Yet, on behalf of the owners, it was submitted that they exercised every precaution. If this is so, then it is a confession that precaution will not avert danger with electrical machinery in a coal mine. The case for electrical operation was made even worse by the further statement, excuse, or whatever is the correct term for it, that the seam where the accident occurred is one where there is seldom, if ever, any trace of gas. Fines were imposed upon certain of the defendants. It is such cases as this that cause miners to look with suspicion upon electrical working, and consider that it introduces into collieries a fresh element of danger to workmen's lives. We have this view mirrored in the annual report of Mr. John Wadsworth, the General Secretary of the Yorkshire Miners' Association. He says it is his conviction that no electricity should be taken to the coal face in any coal-mine because of the risk of explosion in the event of a defect developing in the machinery or in the pit itself. The conditions that exist in coal-mines are not conducive to refined upkeep of electrical plant; and even in mines where there is the most scrupulous supervision of the plant, trouble has arisen in unexpected places and at unexpected times.

Economy in Criticism.

The "Electrician" calls its readers' attention to a passage in our recent editorial article on "Train Lighting and Uncorroborated Evidence." The passage is: "The Inspectors engaged in the work of other Government Departments do not appear to trouble themselves, though faced by a long roll of fatalities, regarding the expulsion from mines of electricity used for power purposes, with a recommendation that its place be taken by compressed air, or from factories and workshops, with a proposal that other forms of power with fewer mantraps associated with them should be adopted." Our contemporary remarks: "Till we read our contemporary, we had always imagined that, in comparison with the fatalities from gas explosions in mines, the electrical fatalities were negligibly small." Of course, our contemporary has been too busy to observe that of late years certain of the most life-robbing explosions in mines have been attributed to electrical causes. Then, it proceeds to state: "In comparison with the output, the electrical fatalities in our works and factories are also negligibly small." This is beautifully vague. "Negligibly small" is a convenient term; but its use in connection with the loss of life through electrical causes suggests an unpleasant callousness. However, our contemporary has had its say over one passage of the article on "Train Lighting and Uncorroborated Evidence." Perhaps now it will turn its attention to the other points that were made. We shall be very pleased to discuss them with our contemporary if it expresses any desire to do so.

A Dutch Work on the Chemistry of the Gas Industry.

We have received from the publishing house of J. B. Wolters, at Groningen, in Holland, a copy of a new work on the "Chemistry of the Gas Industry and the More Usual Methods of Analysis" ("De Scheikunde van het Gasbedrijff en de meest gebruikelijke Methoden van Onderzoek") by Heer G. A. Brender à Brandis, the Engineer of the Corporation Gas-Works at the Hague, and Reader at the Technical College at Delft. The work comprises 340 pages, and is divided into seven chapters, of which six refer to coal-gas manufacture and one to carburetted water-gas and oil gas. There are also a number of useful tables. A fuller review will be given in an early issue of the "JOURNAL" of the contents of this valuable text-book, the price of which is 7·90 florins – 13s. 2d. at the normal rate of exchange.

FUEL ECONOMISTS.

By W. J. A. Butterfield, F.I.C., Assoc.Inst.C.E.

[*Concluded from p.* 628.]

Carbonization of Coal.

It is unnecessary in the "Journal" to deal exhaustively with the question of the merits of the carbonization of coal and the direct use of the resultant coke as boiler fuel, because most of the readers have already had opportunities of working it out for themselves. Whether it would pay to treat coal thus, solely with the object of using both the coke and the coal gas as boiler fuel in a large power station, is, however, a question which stands on a somewhat different footing. Gas-works and coke-oven works depend for their commercial success on being able to obtain for their primary products—gas in the one, and coke in the other case—a substantially higher price than the equivalent in heat units of coal, because coal gas and oven coke have great advantages over coal for special purposes. For the firing of large boilers, however, gas (as already demonstrated) has only a comparatively small advantage over raw coal, and coke has practically none. Carbonization involves, in practice, a loss of 15 to 25 per cent. of the calorific value of the coal carbonized; and if both the coke and the gas made are to be used merely as boiler fuel, it would appear that the tar, ammonia, and other bye-products recovered must pay for the greater part of this loss, and also for the working expenses and interest and depreciation charges on the carbonizing plant. If the tar is not used as boiler fuel, and benzol is extracted from the gas, the gas and available coke—whether made by high or low temperature carbonization—will represent only 65 to 75 per cent. of the calorific value of the raw coal, and, through them, therefore, not more than about 60 per cent. of this value would be utilized in boilers in the evaporation of water.

With regard to the return from tar and benzol, there is, in normal times, a limit to the prices obtainable for them, which depends on the competition of alternative materials or alternative sources of supply immediately that limit is reached. The only unlimited market for either of them which can be foreseen is the fuel market, though, for tar, road construction may be a valuable auxiliary outlet. The existing supplies already far exceed any possible requirements of the synthetic colour and drug industries, and, in normal times, of the explosives industry also. There is no question that carbonization of any large proportion of the raw coal now consumed for power purposes would yield quantities of tar and benzol so great that there would be no hope of their prices being maintained much above figures corresponding with their relative calorific values as compared with raw coal and petrol respectively. Independent carbonization of coal for the supply of gas and coke for use merely as boiler fuel seems out of the question; and fuel economists must suggest other schemes if they wish to displace the use of raw coal as a boiler fuel in large power stations.

If, however, the fuel economist will promote a much more extended use of coal gas as a domestic fuel and for many classes of furnace work (large boiler firing excepted) its value for these purposes is so much greater than the equivalent (in heat units) of raw coal, that a comparatively high price can be obtained for it. The large quantity of coke produced at the same time will then become available as a boiler fuel for large power stations at a price at which they can afford to buy it in competition with raw coal. But the fuel economist who adopts such a sensible view need not proceed to follow Professor Armstrong and academical theorists in condemning present gas-works' methods, which are condemned only by those who know the least about them from the standpoint of the chemist and engineer. The evolution of methods in the gas industry to meet the changing requirements of users of gas, and to recover useful bye-products, has been continuous and rapid; and the gibes of academical theorists merely bring discredit on their promulgators.

Carbonization of Coal and Gasification of Coke.

The carbonization of coal, and the gasification of the resultant coke, with the object of using the producer gas, with or without the coal gas, as a boiler fuel in large power stations, is a procedure which can only supersede the use of raw coal for the purpose if either the chief bye-products—tar, benzol, and ammonia—are saleable at abnormally high prices, or the coal gas is retained for sale for domestic use and the other purposes for which it is a superior fuel. As such, coal gas can command a high price, which will cover the heat losses on carbonization and the working expenses and capital charges on the carbonizing and recovery plant, a simpler, and less costly, type of producer can be used for the gasification of coke than for bituminous coal; and in a power station adjoining a gas-works it is quite conceivable that it might be worth while gasifying the coke instead of using it directly as a boiler fuel.

Conclusions.

Professor Armstrong's proposal that the use of raw coal as a domestic fuel should be forbidden—at latest ten years hence—coupled with his condemnation of gas coke is so far divorced from the sphere of practical affairs that it is unlikely to receive serious attention even from men who have no technical knowledge of the fuel industries. Fuel economists of a practical turn of mind will do best to encourage by all means in their power the extension of the use of gas as a domestic fuel. Where solid fuel cannot be wholly displaced, gas coke and coke briquettes should be substituted as far as possible for raw coal; but when the latter must be retained, every effort should be made to enforce the adoption of economical grates and ranges.

As regards the use of raw coal for power purposes, economists may aid its abolition by encouraging efforts to improve the large gas-engine, and, indirectly, by encouraging the use of coal gas as a domestic fuel and for the many industrial purposes for which it is eminently superior to other fuels—thereby providing a liberal supply of gas coke at a moderate price for use as a boiler fuel, either with or without preliminary gasification. Neither the direct gasification of bituminous coal nor its carbonization at low temperatures seems to have any prospect of competing with raw coal for boiler firing in large power stations. There is always the risk that the coal consumed in smelting the iron and baking the fire-brick required in the construction of large producer and carbonizing plants may be really wasted, in ill-directed efforts to prevent by novel methods "waste" of fuel in various directions. It is important that fuel economists should realize that when raw coal—especially in the form of dust—is burnt in large modern furnaces, the saving which may theoretically be effected by the use of producer gas or the like is often small. Expensive plant for gasifying raw coal must be shown to be capable of giving an adequate return; otherwise the coal resources of the country will have been appreciably depleted in the construction of plant which is unremunerative. Economy of fuel does not lie that way.

The foregoing observations and arguments apply only to the grades of bituminous coal which form the bulk of the supplies of raw coal for domestic consumption and the production of power. Special grades of coal—some exceptionally rich in volatile matter, others overloaded with ash, and yet others which are physically too tender or too small for general use in their raw state—may, of course, be advantageously utilized by low-temperature carbonization, or in Mond or Kerpely producers, or in other appropriate manner. The decision as to the most suitable method of utilizing such special grades of coal, of which large supplies are available, must rest with the fuel expert, and will depend not merely on the special nature of the particular coal, but also on local market and transport conditions. For dealing with such special cases, there are ample opportunities for the development of special gasifying and carbonizing (low temperature and otherwise) processes; and it would be well, in the interests of fuel economy, that the application of these processes should be restricted to the cases for which they are peculiarly fitted. Misguided attempts to apply them broadcast to the general run of household and boiler coal do the processes themselves the worst possible service, and they are greatly to be deprecated.

A final word on a cognate issue. The industrial development, and future prosperity of Britain when the present war comes to an end, will depend fundamentally on power, heat, and light being obtainable at the lowest possible charges. Native coal is the only generally available source of either; and it is imperative, therefore, that it should be won and transported at the lowest possible cost consistent with due conservation of the supply for later generations. Consequently, only the most economical machinery, labour, and administration must be made use of in the winning and transport of our coal; and any plant, man, or method which does not approximate to giving the best possible return in these public services must be ruthlessly "scrapped" in the vital interests of the community at large. State intervention and compulsion should be forthcoming if the end in view cannot be attained without them.

Sulphate of Ammonia Fertilizing Experiments.

A pamphlet has been issued by the Department of Agriculture of the Leeds University containing suggestions with special reference to the use of sulphate of ammonia in the manuring of various farm crops. It is pointed out that as the usual supplies of nitrate of soda will not be available this year, farmers will have to rely mainly on sulphate of ammonia for an active nitrogenous manure. Experiments have been conducted in the East and West Ridings of York on land varying in character. In the case of the barley crop, it is pointed out that by a moderate application of sulphate the yield of grain has been increased from 3¾ bushels per acre up to 7½ bushels. These results were obtained from experiments on different classes of soil, and under the varying climatic conditions of different years. The yield of oats at the experimental farm at Garforth was increased by 9¼ bushels of grain and 4½ cwt. of straw per acre. For potatoes, sulphate of ammonia has been in great favour. Combined with farmyard manure and a mixture of artificial manures containing superphosphate and sulphate of potash, an application of 1 per cent. has increased the crop by 15¾ cwt. per acre. This is the average result of 29 trials conducted over a period of six years. As the result of 44 trials in eight seasons, it was found that an application of ½ cwt. of sulphate of ammonia, in addition to dung and superphosphate, increased the yield of swedes by 12 cwt. An application of 130 lbs. of sulphate gave, in the case of meadow hay, an average increase in four years of 6¾ cwt. per acre.

THE CARBONIZATION OF PITCH.

[Communicated.]

The discussions which have appeared in the Technical Press of late on the above subject indicate that there are two quite distinct aspects of the problem. The carbonization of pitch may be looked upon purely as a commercial problem, in which case it is entirely a matter of pounds, shillings, and pence. From the other point of view, the idea is that, by the use of pitch in carbonizing plants, the continuous increase in stocks will be arrested, and the tendency will be to keep the price of tar from falling any lower than it is at present. The latter is supposed by some to be put forward as a patriotic proposition; but, after all, this at bottom has a touch of commercialism.

THE COMMERCIAL ASPECT.

Let us consider the proposal firstly from the commercial standpoint, as indicated above. In the carbonization of ordinary pitch the yield of coke may be taken as 60 per cent., of various oils 20 to 25 per cent., and of permanent gas 15 to 20 per cent. At present, pitch of this quality can be bought at about 15s. per ton delivered. No doubt if there was any considerable demand for it, the price would soon begin to go up; but for the purpose of the present argument, 15s. is a fair basis to take. In the carbonization of 100 tons of pitch mixed in with coal (say) on a bye-product coke-oven plant, the cost would be 1500s. The coke produced (60 tons), taken at the existing maximum price of furnace coke (24s. per ton), would yield 1440s. The 20 per cent. of oil would be again recovered in the tar, giving, on this basis, a yield of 20 tons; and this might be taken at (say) 20s. a ton, giving a total value of 400s. Of ammonia and benzol recovered from the pitch, the quantities of these are probably so insignificant as to be negligible. We do know that traces of ammonia are sometimes found in the distillation of pitch; but with a good hard pitch, such as would be used for carbonizing purposes, the amount, as stated above, would be negligible. With regard to benzol or light oils in general, we could not expect much of these to be formed. There is, of course, the possibility of some reactions taking place which would result in the formation of hydrocarbons of the benzene series; but, judging from analogous cases, we should hardly expect this to happen. The value of the permanent gas produced from the pitch may be taken at approximately 6d. per ton of pitch or 50s. in all. The cost of dealing with the pitch may be taken as being about the same as that of dealing with ordinary coal—say, 2s. 6d. per ton of coke, or 150s. We now get at the following balance-sheet.

Costs:		
100 tons of pitch, at 15s.	£75	0
Labour, at 2s. 6d. per ton of coke	7	10
Total cost	£82	10
Revenue:		
60 tons of coke, at 24s.	£72	0
20 tons of tar, at 20s.	20	0
Gas, at 6d. per ton of pitch	2	10
Total revenue	£94	10
Total cost	82	10
Profit on 100 tons of pitch	£12	0

No allowance is here made for depreciation, repairs, taxes, &c.

The above figures are, of course, only put forward as a hypothetical case, as, obviously, the yields depend on the quality of the pitch used, the price at which it can be bought, and the prices at which the products can be sold. There are no doubt cases in which a much more favourable balance-sheet can be brought out, as many writers have asserted that they would be glad to get even 10s. or 12s. per ton for their pitch.

THE TECHNICAL ASPECT.

Many objections have been put forward against the carbonization of pitch in bye-product coke-ovens; but the writer is quite convinced that none of those he has yet met with are insuperable. As already stated, it must be hard pitch which is used, as this contains less volatile matter, is more easily broken up, and is generally easier to deal with. In most cases with which the writer has met, two principal causes have accounted for the lack of success in dealing with this matter—viz.: (1) Insufficient mixing of the pitch with the coal before charging; and (2) attempts to use too much pitch with the coal. If we take as an average a yield of 3 per cent. of pitch on the coal carbonized—bearing in mind that a proportion of pitch is again recovered as such in the tar—we get the idea as to what quantity is available. A maximum admixture of 5 per cent. is, in the writer's opinion, the best to work with, as at this figure most of the troubles usually met with are eliminated. On a fifty-oven plant, carbonizing (say) 300 tons of coal, this proportion would necessitate the addition of 15 tons of pitch per day—a quantity which can easily be dealt with. The pitch should be roughly crushed, then mixed with the coal before passing to the disintegrators. This procedure ensures the thorough pulverizing of the pitch, and also results in the most intimate mixing possible.

The argument in favour of the use of pitch is sometimes put forward that the quality of the coke is improved thereby. In the writer's opinion, although this is undoubtedly true, it is not really worth the consideration of coke-oven people. To make any substantial improvement a very considerable quantity would be required, and the difficulties involved in its use far outweigh the advantages. With only 5 per cent., no fear of the mixture "running out of the doors of the oven"—as a speaker recently put it—need be experienced, neither are the smoke and flame produced in charging the ovens excessive. If an undue proportion of pitch is used, it must be remembered that some of this finds its way into the resulting tar; and the latter becomes more of a pitchy nature itself, and is thereby both more difficult to handle and also less valuable than the normal product.

Some very definite experimental work is required on the whole subject; and anyone who is able to carry it out will render great service to the industry. In matters of this kind, Government assistance and direction ought certainly to be forthcoming.

SIXTY YEARS AGO.

From the "Journal" for March 18, 1856.

Threatened Trade Inquisition.—Truly we live in times when constituted authorities appear to fancy themselves bound to right the wrongs of everybody, and to surround the exercise of the ordinary avocations of life with so many precautions that it is almost impossible to live. The numerous class of small shopkeepers and tradesmen are now being made to feel the effects of the Socialist doctrines they themselves were so anxious to apply to the public companies and the large industrial establishments they fancied to be established at their expense; and the provisions of several Acts they assisted in passing are now in course of application to themselves, as though it had been intended to convince them that the infliction of a wrong of any kind invariably recoils on its authors. That most ridiculous and iniquitous measure, the Public Health Act, was obtained mainly by the support of the municipalities, who were set in motion by the desire for cheap water, cheap sewerage, and cheap gas. Under cover of the excitement thus created, a series of enactments were smuggled through the Legislature, the effect of which is simply to place the whole of the trading community, agricultural or municipal, at the mercy of a set of ignorant quacks, called Inspectors of the Central or of the Local Boards of Health.

Royal Visit to a Gas-Works.—A letter was received on Monday evening, March 10, announcing to the authorities of the Chartered Gas Company that on the following day His Royal Highness the Prince of Wales would visit the Westminster station of the Company, and inspect the process of manufacturing gas. Next day came, and with it, sure enough, a goodly and distinguished group of visitors, including His Royal Highness the Prince of Wales, Prince Alfred, Colonel Phipps, and Mr. Gibbs, the accomplished Tutor to the Princes. They were duly received by the Governor (Benjamin Hawes, Esq.), the Deputy-Governor, a majority of the Directors, the Secretary (Mr. Burls), and the Consulting Engineer of the Company (George Lowe, Esq.); while to the Superintendent of the station (F. J. Evans, Esq.) was confided the important task of conducting the distinguished party over the works, and explaining the various operations of the manufacture of gas. Suffice it to say, that everything was seen, inquired into, and comprehended by the Royal strangers—the retorts, condensers, and purifiers were all shown in full action; a small experimental apparatus, in which the process of making gas was exhibited on a minute scale, elicited much admiration; and the comparative values of the cannel and common gases made at these works were seized upon with an intelligence and avidity that seemed almost to imply a previous acquaintance with the details of photometry. The distinguished party remained more than an hour-and-a-half, and quitted the works evidently much gratified with their visit, the proof of which has since assumed a tangible form in the shape of a very flattering letter of thanks to Mr. F. J. Evans for his attention on the occasion. This is, we believe, the first visit of British Royalty to a gas-works in this country.

Informal Meeting of Scottish Gas Managers.—We are informed by Mr. J. W. Napier, of Alloa (the Convener) that the Informal Meeting of Scottish Gas Managers will take place in the Grand Hotel, Charing Cross, Glasgow, on Wednesday, April 5, at 1.30, when Mr. Alex. Mackay, of Motherwell, will deliver an address.

Formation of Coal.—In discussing the microscopic nature of coal before a recent meeting of the Society of Dyers and Colourists, Dr. Hickling stated that, after extensive examination, the general impression left was that coal consists mainly of unfilled vegetable tissue. The transparent, visibly homogeneous material that constitutes almost the whole of bituminous coal must originally have been in a liquid condition, and so forced its way through the membranous walls of the cells, completely filling them. The process would be one of ordinary diffusion through a semi-permeable membrane; the original liquid content of the cell having diffused out and been replaced by the coal substance. The cell-wall itself, doubtless, remained saturated with the substance, and, indeed, its own material seems in most cases to have been gradually dissolved in the general mass. It is considered that what actually did happen during the formation of coal was that by far the greater portion of the carboniferous vegetation which now remains as coal was reduced by decomposition (probably bacterial) to a liquid state; the liquid being then soaked-up by the still undecomposed residues of the vegetation.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The Annual General Meeting of the Association was held last Thursday, at the Grand Hotel, Birmingham. There was a good attendance of members.

At the beginning of the proceedings,

The Hon. Secretary (Mr. W. G. S. Cranmer, of Willenhall) remarked that he had received an apology from the President (Mr. W. J. Rendell Baker) for his absence. He was unable to be present in consequence of the death of his wife's father, whose funeral he was attending. Under the circumstances, he (the Hon. Secretary) thought that their immediate Past-President—Mr. W. S. Morland, of Gloucester—should occupy the chair until the time came for the induction of the new President.

Mr. Morland, on taking the chair, remarked that he was very sorry to hear that the President was unable to be present.

Confirmation of Minutes.

The Hon. Secretary read the minutes of the last meeting; and they were confirmed.

Apologies for Non-Attendance.

The Hon. Secretary said he had received a number of letters apologizing for absence from the meeting. Among them was one from Mr. W. R. Cooper, who was very unwell, and unable to venture out during this weather. Another was from Mr. T. Brooke, the Superintendent of the Nechells works of the Birmingham Corporation. He had been away for some time suffering from gas poisoning.

Annual Report and Accounts.

The annual report of the Committee and the accounts were next presented. The former sketched the proceedings of the year, and then concluded as follows:

> Special general meetings were held on April 15 and May 27, which were addressed by the late Mr. Edward Allen, who explained the "C" process for toluol recovery, and pointed out that it was the patriotic duty of every gas undertaking to adopt the process.
>
> Technical classes for gas-fitters were held at Birmingham, West Bromwich, and Wolverhampton, with the following results:

Birmingham	Grade I.	Passed 12	Failed 0	—
	Grade II.	Passed 5	Failed 0	—
	Final	1st Class 9	2nd Class 5	Failed 1
West Bromwich	Grade I.	Passed 1	Failed 1	
	Grade II.	Passed 0	Failed 3	
	Final	Passed 2	Failed 0	
Wolverhampton	Grade I.	Passed 8	Failed 0	

> Your Committee regret to report the deaths of Mr. W. Langford, of Longton, and Mr. Edward Allen, of Liverpool.
>
> During the year four new members have been elected, two have died, and three have resigned; the membership now being 114.

The Chairman observed that it would be noticed from the report that the amount brought forward was £62 13s. 10d.; and this compared very favourably with previous years.

Mr. B. W. Smith (Walsall) proposed, and Mr. J. S. Cranmer (Stratford-on-Avon) seconded, the adoption of the report and accounts.

This was agreed to.

Report of the Commercial Section.

The Chairman said the next item on the *agenda* was the report of the Commercial Section; and Mr. Bell would propose its adoption.

Mr. J. Ferguson Bell (Derby) said it afforded him much pleasure to move the adoption of the report of the Commercial Section. The members would be glad to know that during the year the membership had increased to 44. They started the section with 36. They had held during the year three general meetings and six Committee meetings, at which various matters of a commercial character were discussed. The year 1915 had been a very strenuous one for all gas undertakings; and he ventured to say the Commercial Section had rendered great assistance to those undertakings and engineers who were associated with it. They had resolved to go a step forward. In the first place, they had decided to take a room at the Grand Hotel, Birmingham, on the first Thursday of each month for the holding of meetings, at which any question concerning their commercial interests could be informally discussed. Then their monthly statements had hitherto been confined chiefly to stocks and sales of coke. Now they had extended the list by including tar and liquor, oil from carburetted water gas, spent oxide, and other matters. Therefore, he thought the members would agree with him, the monthly statements would now be of greater advantage to the members on account of the additional information contained in them as to the prices of the various commodities in which they were interested. He formally moved the adoption of the report.

Mr. Hubert Pooley (Leicester) seconded the motion, which was unanimously agreed to.

New Members.

The Hon. Secretary said the following gentlemen were recommended by the Committee for election: Mr. C. M. D. Belton, of Shrewsbury, Mr. L. J. Langford, of Stoke-on-Trent, and Mr. W. Orme, of Dronfield.

On the proposition of Mr. W. C. Jones (Brierley Hill), seconded by Mr. H. E. Copp (Etruria), the three gentlemen were unanimously elected members.

Benevolent Fund of the Institution.

The Hon. Secretary read the following communication which he had received from Mr. Walter T. Dunn, the Hon. Secretary of the Benevolent Fund of the Institution of Gas Engineers:

> With reference to the deficit on last year's accounts, amounting to £52 19s. 8d., which has arisen in consequence of losses of subscriptions by death, and to the increased number of applications for assistance, it has been thought that possibly your Association might be disposed kindly to make a donation which would aid the Committee in continuing the existing grants, and in dealing with new applications which are likely to be made.
>
> Last year the following donations were received from District Institutions:

Manchester District Institution	£10	10	0
North of England Association	10	10	0
Wales and Monmouthshire Institution	2	2	0

> Would you be so good as to bring the suggestion under the consideration of your Committee.
>
> I need scarcely add how greatly the Committee of Management will appreciate their help.

The Chairman observed that some years ago, in Mr. Meiklejohn's time, they had a "whip-round" in the Association, and got a good many members to subscribe to the Benevolent Fund; and they also made a contribution from the funds of the Association—he believed of 25 guineas. Since then their funds had been somewhat depleted. Besides subscribing to the Benevolent Fund, they also subscribed to the Livesey Memorial Fund; and these drafts drew their bank balance down rather low. Now they had a balance of £62 13s. 10d. If the members thought they might get rid of some of this by subscribing to the Benevolent Fund, now was the opportunity. Those members who did not subscribe to the fund should do so. There was no fixed amount; and any sum, even as low as 5s., would be gladly received.

Mr. J. Ferguson Bell said, as an old member of the Benevolent Fund Committee, he was aware of the great good that was done. He wished to propose that a sum of 10 guineas be voted to the fund from the balance they had in hand. This was not an Association for the accumulation of money; and they could afford the amount he had named. This, however, would not absolve the members from making personal contributions.

Mr. Samuel Glover (St. Helens) seconded the motion; but he said he would have done so more heartily if Mr. Bell had put the contribution at 20 guineas. He suggested that the amount be increased to this sum.

Mr. B. W. Smith (Walsall) supported Mr. Bell's motion.

The President-Elect (Mr. C. H. Webb, of Stourbridge) pointed out that Mr. Dunn in his letter stated that the deficit on last year's account was £52 19s. 8d. If the Association contributed 10 guineas towards this, and the other Associations did the same, surely they would be doing their share. There might be a deficit another year, and then another invitation to contribute.

Mr. Thomas Berridge (Leamington) said there ought really to be no difficulty in getting the money to meet the deficit, and he supported Mr. Bell's proposition.

Mr. Copp remarked upon the fact that the Association's balance had been dwindling the last few years.

Mr. Vincent Hughes (Smethwick) thought the Midland Association did their share very nobly to the Benevolent Fund. Speaking broadly, about 80 per cent. of the members subscribed to the Benevolent Fund; and if members of other Associations did so in like proportion, then a whip-round would not be necessary.

Mr. Glover said, after the remarks that had been made, he would not press for the 20 guineas, but would support the vote for 10 guineas.

Mr. George Helps (Nuneaton) also supported the 10 guineas. At the same time, he rather doubted if 80 per cent. of the members of the Association subscribed to the fund, though he would be very pleased if the statement were true. He was told that there were certain members of the Benevolent Fund Committee who were not subscribers to the fund. To which he replied, that if it were so, the members would soon become subscribers.

Mr. Berridge, in reply to the President, said that he thought it was quite in order to appoint men who were non-subscribers on the Committee of Management, though he did not think it was actually the case that there were such men upon it. The reason that there was the possibility was that on the Committee there were seven members appointed by the subscribers, also the Hon. Secretaries of the Associations affiliated to the Institution, and three members (elected by the Council) from the Finance Committee of the Institution.

The motion was unanimously carried.

The New and the Late President.

The Chairman said he had now to ask their President for next year (Mr. C. H. Webb, of Stourbridge) to take the chair. He had no doubt that Mr. Webb would conduct the business of the Association in such a manner that it would redound to his credit, and to that of the Association. He handed to Mr. Webb the badge of the presidential office.

Mr. Webb on taking the chair was very heartily received.

The President said the first duty he had to perform was to propose a vote of thanks to their Past-President (Mr. Rendell Baker) for his services in the presidential chair during the past two years. Owing to the war, this period had been a difficult one for a President. Mr. Baker occupied the office for the second term really with the feeling that it would possibly be for the benefit of his successor. It was hoped that the war would have been over in the year just expired, and that the President who would follow Mr. Baker would have a clear course and an easier time through the nation being at peace. The hope had not been realized; but he (the President) trusted that peace would be restored during his year of office.

Mr. Morland seconded the motion, remarking that there was no doubt Mr. Baker had had two very difficult presidential years.

The proposition was carried.

District Representative on the Institution Council.

Mr. Copp moved that the President be elected district representative on the Council of the Institution of Gas Engineers. This was a position to which a great deal of honour attached; and he was perfectly certain the President would fill it not only with credit to himself, but also to the satisfaction of the members.

Mr. W. H. Johns (West Bromwich) seconded the motion, which was agreed to.

The President thanked the members for the expression of their confidence. He assured them that he would do his best to serve the interests of the Association.

Reports of District Associations.

On the proposition of Mr. S. Glover, seconded by Mr. Bell, it was decided that the annual volume of "Transactions of the District Associations" should be forwarded to the members.

A Vote of Sympathy.

Mr. W. C. Jones (Brierley Hill) remarked that one of the members, Mr. G. A. Collins, of Dudley, was seriously ill; and he (Mr. Jones) thought that an expression of the sympathy of the members going to him on his bed of sickness would be much appreciated by him.

Mr. Berridge, in seconding, said Mr. Collins was a very old member of the Association, and a regular attendant at the meetings. Though he did not speak much, he was ever ready to give of his experience. They hoped he would soon get better, and be among them again.

The President said, as a neighbour, Mr. Collins had frequently been up to have a look at his works, and he had been to Mr. Collins's, and they often had a talk over affairs in which, as gas men, they were mutually interested. They all felt very sorry for him in his affliction; and he supported Mr. Jones's suggestion.

The proposal was unanimously agreed to.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—Allow me to thank you for the honour you have conferred upon me by electing me your President. It will be a great pleasure to preside over your meetings in the ensuing year, as I feel sure I can count on the loyal and cordial support of every member in carrying out the duties of the position. Needless to say, nothing shall be left undone which lies in my power to further the interests and aims of the Association.

We deplore the loss of two members during the past year—Mr. Edward Allen and Mr. William Langford. Both these gentlemen were of a type we can ill-afford to lose, and the case of Mr. Allen was particularly sad, as there is no doubt his death was due to the very heavy work he had undertaken in the service of the Nation.

According to our rules, the object for which the Association is established is to promote the advancement of the gas industry in all or any of its branches. One of the rules states that meetings of the Association shall be held in February, May, and October of each year. As one who has the interests of the Association at heart, I do not see that the object for which it was formed can be fully carried out when only such a small number of meetings are held, especially seeing that usually one of these meetings is a visit to some works, when no technical business is transacted. This means that on only two occasions per annum do we discuss matters relating to our industry. In a profession whose branches are so many and varied, there must be far more subjects to be investigated and discussed than can be undertaken at only two meetings. I am in favour of a greater number of meetings, and of a different way of dealing with our subject-matter. I believe that short communications, or collections of notes, would be more effective than the lengthy papers usually provided, in producing interesting and useful discussions. The preparation of a long paper is a matter involving great expenditure of time and labour; and as (referring to the rules again) the greater number of our members are engineers or managers of gas undertakings, or superintendents of gas-works making 500 millions or more per annum, the onerous nature of our duties prevents us from giving up the time required in preparation. A short collection of notes does not involve so much labour, and yet can be made to cover the ground sufficiently to induce the desired discussion. I further think that the man who should best be able to undertake the preparation of a long and detailed paper on the working of any particular portion of our various processes, is the member of the Junior Gas Association who, as a technical assistant or superintendent at a medium-sized gas-works, can, with the permission of his chief, devote a great deal of time continuously to observe the working of any process, and to collect the necessary statistics relating to it. Our time and experience are better used, to my mind, in considering the results and statistics thus accumulated by our assistants, in their relation to, and general bearing upon, the running and economy of the undertakings we control.

In the course of my remarks, I shall mention several subjects on which information would be useful to the members of the Association; and I trust that those who are in a position to assist will come forward during the year, and give us the benefit of their experience.

THE WAR.

This is the subject that is naturally uppermost in our minds at the moment. The effect upon our industry is felt in every direction. Prices of raw materials have naturally advanced—coal, gas oil, &c., being much dearer than formerly, owing to the difficulties caused by shortage of labour, increased wages, and transport problems. In fact, at the present time, the quotations for gas oil are almost prohibitive. In the case of coal, the Price of Coal (Limitation) Act has had, I think, a very good effect, though when it was passed many of us were inclined to doubt its value.

Assuming sufficient coal to have been bought, many engineers have still found great difficulty in getting it from the collieries to their works; and the past twelve months have shown, more than any other period, the great advantages obtained by the ownership of waggons. Those undertakings which have had to depend on colliery and railway companies' waggons have, in a number of cases, fared very badly during the past winter. At Stourbridge, we are fortunate in having a sufficient number of waggons of our own to bring in the whole of the coal required during the summer months, leaving only the extra quantity above that necessary in the winter to be carried by other waggons.

I am glad to see that the proposal recently brought forward as to the "pooling" of waggons, has apparently been dropped, as this would have been penalizing those undertakings which had provided themselves with waggons, in favour of those who had not. There would have been no objection to the pooling had it been necessary for Government purposes.

The war has also caused us great anxiety in the direction of our residuals, and has brought a new one—viz., toluol, if it can be called a residual—prominently to our notice. I am glad that we are to be favoured to-day with further information on this subject from gentlemen who have been prominent in investigating the various methods of increasing the output of this substance. The difficulties of handling our tar have been very great, chiefly on account of the pitch problem; and more recently sulphate of ammonia has given us serious cause for thought, owing to the cost and short supply of acid. We are informed that the Government requirements of acid are becoming still greater, and we are asked to experiment with a substitute in the form of nitre cake or nitre cake solution. Information as to results obtained on the use of this material from those members who have tried or are trying it will, I am sure, be much appreciated by the Association. Coke has given us trouble in another way; and that is, in trying to satisfy those users of it who have wanted more than we have been able to supply.

Most of us have been worried by the necessity for increased charges for gas, increased income-tax, adjustments of public lighting agreements, &c.; and only a few days ago, as a last straw, I found myself called upon to supply certain information to the Surveyor of Taxes as to excess profits. Still, I imagine that, with true British spirit, we shall overcome all these difficulties as they arise, and, in so doing, feel that we are contributing our part to the attainment of the objects which the Nation has in view.

WORKS TOPICS.

As a very satisfied user of horizontal retorts, carbonizing heavy charges of twelve hours' duration, with good stoking machinery and telpher equipment, I have yet to be convinced that vertical retorts are superior, except, of course, in economy of space.

We are all familiar with cost of repairs, scurfing, fuel consumption, &c., of horizontal retorts; but many of us would like more data on these and other subjects as applied to vertical retorts. Perhaps at a future meeting some members who have vertical retorts under their control will give us some notes upon these points.

A method of scurfing retorts has been adopted at Stourbridge, which I believe is not generally used. No carbon is recovered, but, on the other hand, no labour is required; and it will be generally admitted that the labour expended and the damage done to retorts by bar-scurfing have far more than balanced the value of the carbon obtained. It is our practice when running six beds of eight, or 48 through retorts, to lay-off at least one retort per day for the whole of the 24 hours. Our retorts have two ascension pipes; and when it is desired to scurf a retort the cap is taken off the south end ascension-pipe, and a fire started in it, which creates an up-draught. The south end lid is then closed, and the north end lid opened; thus a current of air is drawn through the retort. When the south end ascension-pipe is burned clear, the process is reversed—*i.e.*, the north end cap is taken off, and the north end door closed, and the south end door opened. By this means, every ascension-pipe is burned quite clear, and every retort is scurfed in rotation in about six weeks.

We have only a small overhead hopper to feed our stoking machine, the capacity of which is about 30 tons, or half-a-day's supply. Overhead sidings run into both sides of the retort-house, from which coal is dropped from the railway waggons into bins, about 12 feet deep, over the hoppers of the coal-breakers. The bins hold about 150 tons each, and duplicate elevators and breakers feed from the bins into the overhead hopper. It was anticipated when the plant was installed that trouble would be experienced by the coal, when stored to a depth of 12 feet in the bins, jamming, and not feeding properly to the breakers. This is not the case usually, and only occurs with exceptionally large coal. The hoppers of the breakers are fitted with swing doors, operated by gearing. The elevator attendant stands on a platform half-way up the elevator, and, by a hand wheel, regulates the swing door below, so that the elevator buckets are always just full. The elevating operation, therefore, takes the minimum of time. Thus, although the overhead hopper is so small, we have a stock of 200 to 300 tons of coal available for the charging machine without the labour of wheeling. Our elevators and breakers being in duplicate, there is not much risk of complete failure.

Repairs to purifiers and their valves generally necessitate a stoppage of gas manufacture, which may not be convenient at the time when the repairs are required. We have at Stourbridge a carburetted water-gas plant with a large relief holder, into which the crude gas is led, and thence to the exhauster, where it mixes with coal gas. A valved connection has been made between the works' main at the inlet of the purifiers and the carburetted water-gas main on the way to the relief holder. Then if the relief holder is empty, and the carburetted water-gas plant shut-down, the purifiers can be closed-off, and coal gas sent into the relief holder for a number of hours, while the repairs to the purifiers, or their valves, are being effected. Then the purifiers are put on again, and the gas drawn from the relief holder and sent through them.

CARBURETTED WATER GAS OR OIL GAS.

Although at the present time, when gas oil is so dear, owing to the cost of transport, that very valuable portion of the producing plant, the carburetted water gas or oil gas apparatus (as I prefer to call it), is being used as little as possible, yet no doubt the use will be considerably extended when oil prices approach nearer to the normal. I have noted a few points which are perhaps worth mentioning.

Great care should be taken to see that the generator steam spray is delivering steam centrally. If delivery is irregular, the generator brickwork will wear unequally, and relining will be required sooner. Meanwhile, the results will fall off, due to the fuel bed receiving too much steam on one side, and not enough on the other. After correcting the delivery of the spray in our plant recently, a permanent increase of nearly 5 per cent., or over 1000 cubic feet per hour, in the gas made, was gained.

It is advisable, if the oil is delivered to the carburettor by steam cylinder, to fit a reducing-valve on the steam supply. By this means, steam is delivered at full volume at the beginning of the run, and at a constant pressure throughout the run. Without such a regulator, the condensation of the steam is only gradually overcome, and the least quantity of oil is delivered at the beginning of the run (when the chequers are hottest), and the greatest quantity of oil at the end of the run (when the chequers are coolest).

As previously stated, the oil gas is mixed with the coal gas at the inlet of the exhauster. The mixed gases are purified jointly, and measured together by the station meter. The oil gas is admitted to the exhauster at a steady rate throughout the 24 hours, and this rate is ascertained by a diagrammatic meter of the type used on the town mains to show the delivery of the gas, and to indicate breakages of mains. This meter (which is quite a small piece of apparatus) is fixed in the engine room, and the attendant, by regulating on the inlet valve, can ensure a constant rate of mixture of the two gases, which is most beneficial. The meter only requires a new chart daily, and, when in regular use measuring the crude gas, cleaning weekly, which operation only takes an hour or less. If this is done, no fault can be found with its accuracy; and in any case, an error is only between the coal gas make and the oil gas make—the total gas made being measured after purification by the ordinary station wet meter.

Whenever unsatisfactory results have been obtained by the use of oil gas, it will be found, I think, to be due to one of the following causes.

If the oil-gas plant is only used for a portion of the day, and the relief holder is too small for the size of plant installed, this necessitates the gas being rushed through to the purifiers as made, and the oil gas, instead of being mixed regularly with the coal gas, is delivered in varying proportions.

If the illuminating power standard is adhered to, and the two gases are made of about the same illuminating power, the combined calorific value is less than that of coal gas alone, which gives trouble with many pieces of gas apparatus in the district.

If, however, the two gases are made of about equal calorific value, then no trouble will ensue, even if the percentages of oil gas in the mixture vary considerably from time to time. This method of giving the full calorific value costs the gas undertaking a little more than if the illuminating power standard alone is worked to, but the extra cost is counterbalanced by the satisfaction of the consumers.

BRITISH AND GERMAN GOODS.

It has been surprising to note during the past year the number of articles required for gas-works purposes which have been, found to be of German manufacture. In a number of instances, we have been informed by the sellers that their stock of some article has been depleted, and that it will not be possible to supply for some time to come; and the country of origin has only been disclosed after further inquiry. On the other hand, it is good to note that when the article has been one in regular demand, and in some quantity, the manufacture of an English substitute has quickly commenced; and, further, that this has often been a considerably better article. It may be said that the cost of the substitute is sometimes more than was previously the case with the original article. But it must be remembered that war conditions are largely responsible for this; and it is to be hoped that, when trade returns to the normal, the price of the English article will drop sufficiently to be able to compete with the foreign one This should be so, I think, if the English manufacturer is properly supported by us as buyers.

I consider English manufacturers would do better if there was more standardization, and a less number of different sizes made in some classes of goods. Taking the case of wrought-iron tubing, surely if 1½-inch tubing is found to be too small for a particular job, then the 2-inch size would not be much too large, and could be used without having the intermediate size—1¾-inch diameter. This would reduce the number of sizes to be stocked by both manufacturer and user, and would result in considerable economy to both. Similarly, in the case of cast-iron mains. At Stourbridge, we only use 4-inch, 6-inch, 8-inch, 12-inch, and 16-inch diameters, each of these sizes being approximately double of the one below.

AN AIR RAID AND THE GAS SUPPLY.

The only time on which I have ever entirely cut off the supply of gas to the town occurred on the occasion of one of the recent Zeppelin raids. The *Zeppelin* passed over the Midlands, and, on receiving warning of the raid by telephone, the Superintendent of Police considered it advisable to have the gas turned off—the town being lighted by nearly 500 lamps, which is rather more than half the total. The supply was renewed at about 8 o'clock the following morning, and no mishap of any kind occurred. As many factories as possible were notified by telephone; and men were sent by motor car in various directions in the district to notify the residents and to turn off the lamps. Since then, the Lighting Order has come into force, and the public lighting has been reduced to a very small amount, and the lamps carefully shaded; so that in the case of another raid, we shall not be called upon to take such a drastic and somewhat dangerous method of dealing with the matter.

OUTDOOR DEPARTMENT.

After experience of almost two years' duration of the advantages of a show-room in the centre of the town, I am thoroughly convinced that no gas undertaking of any size above the smallest can afford to do without one. It should, of course, be arranged that gas accounts may be paid there, as this ensures a steady stream of visitors, who are already users of gas, and who thus have all new apparatus brought to their notice periodically. If sufficient accommodation can be obtained, the outdoor superintendent should have his office in the same building, so that he can be called into the show-room for consultation when necessary. It will generally be found convenient to have the outdoor department stores situated there, and to make it the headquarters for the town fitters and for lamplighters.

Our high-pressure main for shop lighting was completed in October, 1914; and though orders for lamps were few, owing to war time economies, and though the plant has been shut-down entirely since the lighting restrictions came into force, it worked very satisfactorily both in regard to lamps and compressors. The high-pressure main is a steel one, with welded joints. I feel sure that, after the war, considerable profitable business will accrue from this branch.

We dispose of any kind of gas apparatus whatever on hire-purchase terms. The period is usually three years, and a simple form of agreement is issued. One of the most successful branches has been the hire purchase of gas-engines (ours is an industrial district), and sizes up to 50 B.H.P. have been put out. No trouble has been experienced as to payment, and it is found that a 50 B.H.P. gas-engine, working shop hours, means a sale of from 800,000 to 1,000,000 cubic feet annually. If the hire-purchase system had not been adopted, an electric motor would probably have been hired by the consumer, or we should have lost the sale of nearly 1,000,000 cubic feet per annum for three years, assuming that the consumer waited this length of time to accumulate spare capital to purchase the engine for cash. I consider the system is very necessary in a district where electrical competition is keen.

We have had a motor delivery van in use for over two years. Although it was originally a four-seater car, and, on our purchase, had a van body adapted to the chassis, it has done very good work in the delivery of cookers, meters, and in assisting the prepayment meter collectors, and has saved a good deal more than its cost in inspectors' and fitters' time. I am now considering the advisability of recommending my Board to make a further purchase, and think that at a future meeting of the Association it would be very helpful if those members who are using motor vehicles for gas-works purposes would describe the types they have in use, and give the Association some points in the selection of suitable kinds of motor vehicles for gas-works traffic.

BRITISH COMMERCIAL GAS ASSOCIATION.

Splendid work is being done by the Association—results being obtained which, in my mind, could not be approached by any system of individual and local effort. I have had many proofs of the success of the "Advertising Scheme" which is carried out by the Association, and would urge that all gas undertakings should become subscribers, so that the maximum amount of financial and other support shall be given to the movement. As all undertakings must benefit directly or indirectly by the work done, so all should bear their proportion of the expense. The difficulties as to municipal undertakings becoming subscribers have lately been removed. I would refer you to the very interesting March number of the "Bulletin" of the Association, where the "difference that advertising makes" is exceedingly well told.

SULPHATE OF AMMONIA ASSOCIATION.

The same remarks to a great extent also apply to the work of the Sulphate of Ammonia Association, in respect to their propaganda branch, and all undertakings making sulphate of ammonia should not hesitate to contribute their quota to this branch. I must admit I am not yet fully converted to the idea of the selling branch. This may perhaps be because Stourbridge is close to an agricultural district, and no great difficulty is experienced in disposing to local users of a considerable portion of our output of sulphate of ammonia.

CONCLUSION.

In conclusion, I would say that I have had very little spare time during the past few months to devote to the preparation of this address, and can only trust that, embodying as it does some points of my own ideas and experience, it may not be without interest to members of the Association.

Thanks to the President.

Mr. Morland proposed a hearty vote of thanks to the President for his address, the contents of which, he said, would assist them very much in working their own undertakings. Mr. Webb had given them many ideas which they would probably be able to apply in their own works. The address was to the point; and the information in it was excellent.

Mr. Fletcher W. Stevenson (Coventry) said he had had the pleasure of knowing the President for several years, and had had the added pleasure of visiting his works. He was very much struck when there by the many little things that Mr. Webb had that some gas engineers had not, and, indeed, which they had not thought of. No doubt they were useful to him, and would be to others in regulating their works. The President had given them so much information about these things, that there was the danger that he would be flooded with members going to see him, and so have too many visitors. Those who did not know his works would find that they could not go to them without learning a very great deal. They must all feel the address he had given them was an excellent one. It also had the merit (which the President had taken as a demerit) of not being too long. It had held the interest of the members the whole time; and from what he had said in it, they knew they had a President who would be in touch with the Association throughout the year, and would be a help to them all. He wished him every success in his office as President, and had much pleasure in seconding the motion.

The proposition was heartily passed.

The President thanked the members for the reception of the address. The only point he would refer to was as to what Mr. Stevenson had said about visitors. There were never too many visitors to Stourbridge. He was always glad to see brother engineers on any excuse whatever.

Benzol and Toluol Extraction by American Gas Oil and Green Oil.

Mr. John Bond (Southport) and Mr. Hubert Pooley (Leicester) then opened a discussion on the above subject—Mr. Bond giving his experiences as to the extraction of benzol and toluol with American gas oil, and Mr. Pooley with green oil. A report of the discussion commences on p. 689.

Toluol and the Limestone Process.

Mr. Geo. Stevenson prepared a paper for the proceedings on "Toluol and the Limestone Process." It is published on pp. 692-94; but the discussion is deferred under the following circumstances.

May Meeting to be Devoted to Discussion.

At the close of the discussion on the extraction of benzol and toluol by oils,

Mr. J. Ferguson Bell said that the hour was getting late; and he suggested that Mr. Stevenson's paper should be deferred to the next meeting. In the meantime, the members could read the paper; and, as the process was one in which a great deal of interest had been taken, he was certain the delay would result in a better discussion.

Mr. Berridge, in seconding the proposal, agreed that the members would be in a better position to discuss the paper later on.

Mr. Vincent Hughes supported the suggestion.

The President remarked that, as time was going on, and Mr. Stevenson had gone to a tremendous amount of trouble over the paper—largely at his (the President's) request—it seemed to him that it would be better for the paper to be printed and then fully discussed later. As to the meeting, he was going to mention the point. It was not his (the President's) intention to ask the members to visit Stourbridge for the May meeting, because he hoped to do so at a subsequent date. His Committee would like the opportunity of welcoming the members to the town. But they did not feel that the present time, while the war was on, was the best for doing so. When the members went to Stourbridge, they wanted to entertain them well, and show them some of the surrounding country. But at present most gas engineers were very busy; he was himself. And so he was hoping to be able to extend to the members an invitation to Stourbridge after the war was over. It was, however, his intention to ask the members if they would like to hold an ordinary meeting in May. If they did this—say, on the third Thursday in May—Mr. Stevenson's paper would give them suitable subject-matter, and they would have fair time, for discussion. If this met with the approval of the members, he should like to have a May meeting.

Mr. Berridge proposed that the suggestion of the President be adopted.

Mr. Bell seconded, remarking that now was not the time for banquets or anything of that sort. But he did hope the President would be able to invite the members to Stourbridge when the war had been brought to a satisfactory conclusion.

The proposal was adopted; and this ended the business proceedings.

At the invitation of the President, the members afterwards had tea together.

COKE-OVEN MANAGERS' ASSOCIATION.

Lecture by Professor Cobb.

A meeting of the Coke-Oven Managers' Association was held at the Leeds University last Saturday afternoon, especially for the purpose of hearing a lecture on "Refractory Materials and Salty Coals" by Professor J. W. Cobb, Head of the Department of Metallurgy at the University. The President (Mr. George Chrisp) occupied the chair. The attendance was the largest on record in the Association.

The President, at the outset, said that in obtaining the services of Professor Cobb to give the lecture the Association might be heartily congratulated, because, in view of the troubles of to-day, the systematic examination of the problems connected with the carbonization of coal was a very important matter; and anything the Association might do towards solving these problems would be of great good. Professor Cobb was very conversant with the subject, and was about the first man in the country in regard to refractory materials. He had a very interesting array of samples. The problem of salty coal was a vexed one. There were many opinions as to what effect heavy salt had, and they would be able to hear some opinions on this matter. Some of them held views that if the benzol production went down, they could blame the salt in the coal; and they blamed the salt for other things. In the old days, if anything ever went wrong it was usual to blame the washer. Nowadays they were more scientific, and blamed the salt.

Professor Cobb, who was warmly received, then delivered his lecture, illustrated by displayed specimens and lantern slides recording experimental results, on

REFRACTORY MATERIALS AND SALTY COALS.

When men responsible for the technical direction of an industry are once convinced that under the detail of their work lies a substratum of principles which can be unearthed, and a wealth of experience which can be pooled, to mutual advantage, and when it is realized that progress can be secured most effectively by the co-operation implied, that industry enters on a new stage of development. Some such idea, I believe, inspired the formation of the Coke-Oven Managers' Association; and as the head of a department which is very specially concerned with fuel, in a University which has for many years past recognized, or even anticipated, the claims of industries to the best of its services, I welcome warmly the Association and its members.

It is hardly necessary to say to you that at this time we cannot be expected to remember with anything but regret the extent to which the higher technical direction of the coke-oven industry has been imported. There is only one certain remedy; and it is to make the best possible use of every man now in the industry (which necessitates that every man should make the best of himself), and to train up a corps upon which to draw, thoroughly equipped for the work, who can attack with skill and confidence the numerous and complicated problems that are inseparable from rational carbonization.

I propose to say something about one problem to-day; and as to its importance there will, I venture to state, be no two opinions in your minds. A very important item in the running costs of a bye-product coking plant is that of repairs and renewal of oven-walls; and before the reason was grasped, costly miscalculations were made under this head, when the coal to be carbonized happened to contain common salt (NaCl). The walls wasted rapidly, and required frequent renewal; and the wasting was not from high temperature, occurring as it did on the inner faces of the oven-walls, where the temperature was lowest. The evil continues; and although information has been acquired by costly experience, and we now know something more about it, nothing, so far as my knowledge goes, has been forthcoming which can be regarded as offering any adequate answer to the question raised. The difficulty is emphasized in the coals from certain districts. South Yorkshire, North Derbyshire, Staffordshire (Stoke district) are notorious. Wales, on the other hand, is favoured. There has not been sufficient systematic geological work done to afford an explanation of these regional peculiarities. Some observations of my own may throw light on certain aspects of the problem as it affects carbonization industries through the refractory materials used in their plants. That is all I claim, or hope.

SOME EXPERIMENTS ON COALS.

In these days, when the washing of coal before coking has become so very general, it would appear at first sight that the soluble common salt would be washed out as a preliminary. But this is not so. The admixture of the salt with the coal substance is apparently very intimate, and coal is not porous in any ordinary sense. Even when the coal is finely divided, extraction by water is very imperfect.

The following experiment was made on coals which were ground, put through a sieve 12 meshes to the inch, and then over one of 50 meshes to the inch to remove dust. The salts were extracted with hot water, and afterwards with 10 per cent. nitric acid. The results are recorded below.

Chlorine Extracted as Chloride from 100 *Grammes of Coal.*

—	Water Extraction.	Acid Extractions.					Total Extraction.
		1.	2.	3.	4.	5.	
Coal 1. .	·38 4 hrs.	·22 18 hrs.	·116 6 hrs.	·054 29 hrs.	·024 40 hrs.	traces 2 days	·794
Coal 2. .	Slgt. Tr. 22 hrs.	Slgt. Tr. 23 hrs.	—	—	—	—	Trace
Coal 3. .	·36 4 hrs.	·148 18 hrs.	·068 6 hrs.	·028 29 hrs.	·014 40 hrs.	traces 2 days	·618

The slowness of extraction, and particularly the incompleteness of the first extraction, even when the coal was finely divided, and the time of contact extended over hours, are significant.

ANALYSES OF SALTS.

An analysis of the soluble salts extracted by water from finely-divided coal is of interest. Two such analyses are given below:

Weights Extracted from 100 *Grammes.*

—	SO_4.	Cl.	Ca.	Mg.	Na(K).	Total.
Coal A . .	·0064	·121	·014	·0034	·165	·3098
Coal B . .	·0125	·352	·0514	·013	·161	·5899

It is evident that in these cases sodium chloride was the dominant soluble constituent; and since soda would not be volatilized from any such insoluble salt as a soda felspar during carbonization, it is permissible to restrict the consideration of the influences arising from the volatilization of sodium salts to this constituent. Salt goes, then, into the oven with the coal, and experience shows that, if the charged coal contains more than a small quantity (say, 0·05 per cent.) of NaCl, the oven-walls suffer, though a rather larger amount does very little damage if the temperature of coking is low. When the temperature of the oven rises, the salt begins to volatilize.

At 800° C., sodium chloride melts; but it volatilizes in some quantity at lower temperatures. A recent laboratory experiment showed that at 800° C. the volatilization occurred at a rate of 6·9 per cent. per hour, or with relation to the surface of sodium chloride exposed at a rate of 0·17 gramme per square inch per hour, or nearly 1 oz. per square foot. Analysis of the residue showed it to consist of sodium and chlorine in the ratio proper to NaCl; so that volatilization had occurred in the same ratio. It was a pure volatilization of salt as such, neglecting dissociation which would be negligible at this temperature. Calcium chloride, on the other hand, heated under the same conditions, did not volatilize. It lost chlorine, but no calcium. A mixture of lime and sodium chloride simply lost sodium chloride—*i.e.*, sodium equivalent to chlorine—at a rate roughly the same as with sodium chloride alone.

The table appearing below indicates the analytical results on which these conclusions are based. The figures can only be taken as approximations; but their indications are probably useful. Apart from their bearing on the volatilization of salt, the results with the lime-salt mixture would oppose the idea sometimes expressed that the addition of lime fixes to an appreciable extent the chlorine of any sodium chloride present, and so lessens the ammonium chloride vapour in the coke-oven gas. In this respect they agree with my own experience in a matter which is one of great importance, though not the primary object of this lecture.

Losses on Heating for Two Hours at 800° C.

Material Used.	Weight of Material.	Loss of Weight in Gms.	Analysis of Residue After Heating.			Per Cent. Loss on Heating on Original Weight.
			Gms. Na.	Gms. Ca.	Gms. Cl_2.	
Sodium Chloride NaCl . . .	2·5 gms.	0·346	0·83 equivalent to 1·28 gms. Cl.		1·27	13·82
Calcium Chloride $CaCl_2$ . .	3·30 gms containing 2·11 gms. Cl_2.	0·191		1·19 equivalent to 3·31 $CaCl_2$.	1·62	
CaO } NaCl } . .	{ 1·25 gms. { 1·25 gms.	0·142	0·42 equivalent to 0·65 Cl.	0·89 equivalent to 1·25 CaO.	0·64	5·8*

* 11·6 per cent. of the NaCl.

VOLATILIZED SALT AND FIRE-CLAY WALLS.

I wish to deal with the interaction that occurs between the volatilized salt and the fire-clay walls of the oven, which we know to have such disastrous consequences. The ground may be cleared to some extent by getting rid of the assumption that the action—even repeated action—of sodium chloride on the surface of fire-clay has necessarily any very detrimental effect. In the manufacture of what are known as salt-glazed bricks, the walls and arches in the kilns are subjected repeatedly, over many years, to an atmosphere very much richer in sodium chloride vapour than that of the coke-oven during carbonization. What happens is that the fire-brick fire-clay surface is attacked, and a glaze is formed of sodium aluminium silicate—the so-called salt-glaze. This coating having once been applied to the whole exposed face, any further attack of salt vapour proceeds slowly, and with little or no penetration to any part of the fire-brick which lies at the back of the face in the interior of the brick.

The essential condition for securing this comparative immunity from further destruction is that the salt vapour shall not come into contact with the fire-clay face until the temperature of the latter is so high that any compound formed is in a state of fusion. This temperature is about 1200° C. If sodium chloride vapour is allowed contact at temperatures below this, the result is quite different and, in its practical effect for our purpose, much more serious. It has not been realized in the past with sufficient clearness that combination can occur between substances which have for each other sufficient chemical affinity, even when both substances are in the solid state. The combination of lime with silica, or with alumina, at a red heat far below the melting-point of either combining constituent, or of the compound formed, is perhaps the most striking example of this phenomenon, and has been completely demonstrated.*

So far as concerns the formation of sodium silicate, sodium aluminate, or sodium aluminium silicate, the same general principle applies. The interaction of soda and alumina has been traced by experiments, in which a mixture of sodium carbonate alumina and silica corresponding with the formula $Na_2CO_3 + Al_2O_3 + 10\ SiO_2$ was heated to successively higher temperatures, and the degree of interaction determined at each of these temperatures by suitable chemical examination. I reproduce the table of results [see next page].

It was clear that chemical interaction had occurred at comparatively low temperatures, and that compounds were formed, not in fusion at the time of their formation, but ready to fuse when higher temperatures were attained. Applying this result to our analogous case, we may be quite prepared to find that below the temperature of salt-glazing there is not only a penetration of salt vapour into the interior of the porous brickwork, but a fixation of the salt which has so penetrated by chemical combination with the alumina and silica present.

The following experiment may be useful as indicating what amount of sodium chloride can be fixed in water in soluble compounds, when extensive facilities for interaction between common salt and fire-clay are afforded. Finely-ground calcined fire-clay was mixed with a considerable excess of common salt, and was gradually brought up to a temperature of 1200° C. in a works furnace; the time occupied being 72 hours. The sintered mass, from which most of the sodium chloride had evaporated, was extracted repeatedly with water, until the washings contained only traces of soluble salt; and the residue was then analyzed. Its formula was very approximately $Na_2O, 2Al_2O_3, 7SiO_2$, indicating something like the same degree of fixation of soda as found in felspar.

Deduction from laboratory experiments carries us so far; but observation of another kind in large-scale work has shown more. In the ordinary type of salt-glazing kiln, salt is not applied to the fires, and therefore does not reach the interior of the kiln, until the fusing temperature of the resulting glaze has been practically attained; and the excess salt fumes pass straight to the chimney. In a continuous gas-fired salt-kiln which was some years ago in my charge, some of the salt fumes passed through from the chamber in which salt-glazing was being effected to another chamber in

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* See "Journal of the Society of Chemical Industry," "Synthesis of a Silicate." Cobb, 1910, p. 250.

Soda, alumina, and silica ($Na_2CO_3 + Al_2O_3 + 10\ SiO_2$.

$Na_2CO_3 + Al_2O_3 + 10\ SiO_2$ contains
- Na_2O . . 7·7 per cent.
- Al_2O_3 . . 12·6 ,,
- SiO_2 . . 74·2 ,,
- CO_2 . . 5·5 ,,

$Na_2O + Al_2O_3 + 10\ SiO_2$ contains
- Na_2O . . 8·1 per cent.
- Al_2O_3 . . 13·4 ,,
- SiO_2 . . 78·5 ,,

Where Heated.	Time (Hours).	Temperature Deg. C.	Soluble in HCl.			SiO_2 in Na_2CO_3.	SiO_2 Total Soluble	Total Soluble.	Total Insoluble.	Appearance.	Notes.
			Na_2O.	Al_2O_3.	SiO_2.						
		Blank	6·1	..	0·3	..	0·3	6·4	93·6		Na_2O less than theoretical
Muffle. . .	1	800	6·9	0·2	0·5	3·6	4·1	11·2	88·8	Hardened	
,, ...	1	1000	0·8	1·0	0·6	0·9	1·5	3·3	96·7* 96·7†	Hardened	* By difference † Determined $NoCO_2$
,, ...	1	1150	0·6	0·8	0·6	0·8	1·4	2·8	97·2	Very hard, not fused	
,, ...	1	1300	0·6	1·8	1·3	0·7	2·0	4·4	95·6	Stony fusion	
Works furnace	24	1150	1·0	0·4	0·2	0·6	0·8	2·2	97·8* 97·2†	Stony fusion Slightly honeycombed	* By difference † Determined SO_3 = 0·4 per cent.

which the temperature was lower. Examination of a test-brick from this second chamber, when the salting in the first chamber was completed, disclosed no obvious change other than the formation of a slight brownish stain on the yellow face of the brick. When, however, the temperature of the second chamber was raised to make it ready for salting, a strange phenomena, new to me, declared itself, inasmuch as the face of most of the bricks began to blister badly; and for some distance below the blistering the fire-clay was semi-vitrified and honeycombed. Chemical examination showed that soda was present in quantity.

In this case, then, as in ordinary salt-glazing, the interaction of the salt and fire-clay had resulted in combination; but the practical difference of a chamberful of bricks blistered and honeycombed on the one hand, and of smoothly glazed, exactly shaped bricks on the other, was a clear indication that the conditions in the first case—not merely the presence of salt and fire-clay—were the determining cause of the harmful effect. These conditions determined the penetration of the porous brick by the salt vapour below the temperature at which a glaze could form, the formation in the solid state of compounds between the soda and the brick substance, and, finally, the fritting and fusion in the mass, as well as on the face, when the temperature was sufficiently raised at a later stage.

From this point of view, the destruction of the wall in a coke-oven by the salt in the coal carbonized takes place somewhat as follows. At a comparatively low temperature, the salt in the atmosphere of coal gas volatilizes, and, penetrating into the brickwork, combines with its substance. In so doing, it alters physically, and chemically also, the composition of the portion of the wall nearest the face. The temperature of the brickwork is lowest near the face, highest near the combustion flues, and rises gradually from one to the other. The temperature near the face is not sufficiently high to fuse the soda alumina silica compounds formed there. But these compounds have also formed further in, where the temperature is higher; and tracing the temperature towards the inside of the brick, a point is reached where the temperature is high enough to effect fusion—to produce liquidity, porosity, honeycombing, and rottenness of structure making for disintegration.

Herein lies the danger. The brickwork begins to fall away in pieces—to "chatter." It is destroyed, not by the gradual removal of successive thin layers by fusion, but by a much more drastic process of breaking off layers of considerable dimensions. It is very likely several other phenomena come into play in bringing about this final result. As a consequence of chemical alteration in that portion of the fire-brick into which the salt vapour has penetrated, there is an accompanying physical change in coefficient of expansion which may have considerable influence. If the outer layer is expanding and contracting every time the oven is heated and cooled, to an appreciably different extent from the substance at the back of it, this is, in itself, a disintegrating force, and the somewhat vitrified, and therefore more coherent, facial portion of the brick may very well tear itself away as a whole from the entirely unvitrified, and therefore the less coherent, substance behind it.

Another phenomenon which may be of some consequence is the volatilization of iron in the form of chloride of iron, which undoubtedly takes place, followed by the deposition of iron—probably in the metal form, because the atmosphere is reducing—when the volatilized chloride penetrates to a region where the temperature is too high to permit of its continuing in existence; or the ferric chloride may penetrate to a point at which it meets with free oxygen penetrating in the opposite direction from the combustion flue, and oxide of iron is deposited. A layer of oxide is frequently found on the plane of disintegration, when the brickwork of a failing oven is examined after cooling-off.

Laboratory experiments carried out for me by Mr. C. P. Finn demonstrated conclusively the volatilization of iron as chloride from fire-clay, and its after-deposition as oxide under proper conditions. I have noticed the same thing occurring on a large scale when a stream of salt vapour impinges on the bricks in the process of salt-glazing, without having been thoroughly mixed with air and the products of combustion.

There is one change brought about in the structure under the face of the bricks lining the coke-oven which has not so far been insisted upon, or even mentioned, because it occurs even in the absence of salt; but it is a change which may have its own influence in producing disintegration. It is the deposition of finely-divided carbon in the pores of the fire-brick, by the decomposition of methane and other hydrocarbons present in the gas driven off from the coal during its carbonization. Another change which has to be taken into account is the reduction by these gases of the iron contained in the fire-brick from the ferric to the ferrous condition, in which its fluxing power is materially increased. As a result of such action, any small area rich in iron will become doubly dangerous as a centre of fluxing and disintegration.

SUGGESTIONS FOR CURING THE TROUBLE.

So far I have treated of the disease, rather than of the remedy; and at the present moment I put forward no remedy, but would rather like to indicate the lines on which a cure can probably be effected, if proper co-operation is secured between the makers of refractories on the one hand and the coke-oven builder and manager on the other.

In the first place, it is obviously advisable to minimize the amount of penetration through the face by the use of practically non-porous material in that position. Complete exclusion can hardly be hoped for, unless a suitable glaze can be found for both brick faces and joints; and it has to be borne in mind that the repeated expansion and contraction which the face undergoes is the very severest possible trial to the cohesion of the glaze and the material that is behind it. If, then, penetration occurs, the material should be one which will suffer as little as possible from the fluxing of the soda. Among refractories which can be supplied in any quantity, alumina and magnesia stand out as offering distinct possibilities. Alumina does combine with soda, but to form an infusible compound which is decomposed again without fusion when the temperature rises very high.* Pure alumina is a very expensive material; and the commercial form for our purpose would be bauxite, which contains silica, oxide of iron, and titanium oxide, as impurities. There is, however, one very grave objection to the use of bauxite, or any similar form of alumina, for any high temperature work; and this is the great difficulty of "getting the contraction out of it" by any ordinary calcining. A shrinkage in use is commonly experienced. The use of the electrical furnace may with alumina, as with silica, give us a material with excellent properties; and something has already been done in this direction. But the cost of these materials in bulk is likely for many years to come to be prohibitive. Magnesia is another refractory which offers a very high order of resistance to soda; but here, again, the factor of cost is against it. Thin impervious facing layers of these more expensive materials should, however, be carefully considered and tried.

Taking it for granted that fire-clay bricks continue to be used, it is well to consider what conditions they should satisfy. In the first place, the face should be close-grained, and the face and sizes made so exact as to allow the use of small joints. Then the substance should be of a composition physically and chemically best adapted to resist the fluxing action of the salt. Free silica in the brick requires special consideration, because it may act in two directly opposite ways. If it is very finely divided, so as to bring it into effective contact with the clay material, the silicate of alumina, fluxing is enhanced. If, on the other hand, the silica grains are large, the fluxing action of the salt is confined largely to their exterior, and a state of affairs is readily attained in which the clay and fine silica, attacked by the salt, have formed a pasty mass, stiffened and strengthened by the silica grains.

This difference in the action of fine and coarse silica is equally noticeable in its influence on the fusibility by heat alone of clay and clay-silica bricks. A mixture of alumina and silica containing from 80 to 90 per cent. of silica, is, when all the constituents are finely divided, the most fusible of all such mixtures; but the same mixture when the silica grains are coarse does not fuse as one, but more nearly with the average fusibility of its two constituents. This beneficial effect of large-grained silica is due to the minimizing of its interaction with the other material present, which can only take place on the interfaces of particles. It is not that the largeness of the particles in itself increases the stiffening effect, as can be illustrated by a simple experiment which was carried out for me by Mr. C. A. King, in the laboratory of the Farnley Iron Company.

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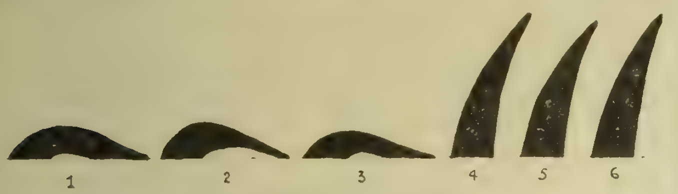
* See "Journal of the Society of Chemical Industry," "Synthesis of a Silicate." Cobb, 1910, p. 403.

The problem was: Given a substance which was softening slightly and bending gradually with its own weight, what size of particle could be most effectively used to counteract the bending when no chemical action was possible between the softer and the harder substances? A pitch was chosen as the slightly softened constituent which, made into the form of a pyramid, like a Seger cone, but 8 inches higher, bent slowly until it lay flat on its support. The stiffening constituent used was ganister; and it was added in different grades of fineness in making a set of pyramids which were placed side by side in the laboratory at the ordinary temperature, and observed. The mixings used are given below, and also the time taken for each pyramid in bending to touch.

		Times of Touching.
No. 1	pitch alone.	22 hours.
No. 2	50 p. ct. pitch and 50 p. ct. sand between 3 and 8 to the inch	4½ days.
No. 3	,, ,, ,, ,, ,, ,, 8 ,, 25 ,, ,,	3 ,,
No. 4	,, ,, ,, ,, ,, ,, 25 ,, 50 ,, ,,	26 ,,
No. 5	,, ,, ,, ,, ,, ,, 50 ,, 100 ,, ,,	30 ,,
No. 6	,, ,, ,, ,, ,, passing through the 100	23 ,,

The accompanying figure shows the degree of bending attained after five days.



Pitch-Ganister—Five Days.

The result of this experiment was decisive in showing that the coarse-grained hard material had actually less stiffening influence on the softer pitch than an equal proportion of the same substance in smaller grains. The admixture of ganister particles of any size did, however, effect some stiffening.

Enough has now been said, I believe, to set out the complex considerations, physical and chemical, which enter into this problem of refractory materials and salty coals; and if any line of either thought or action has been indicated, in however sketchy a manner, which will lead to a satisfactory solution of the problem, not only the coke-oven industry, but the other carbonizing and coal-using industries in general, will have an obstacle removed from their path.

[Professor Cobb mentioned that the specimens had been supplied by Mr. C. P. Finn.]

DISCUSSION.

The Chairman said there was much matter for thought in the lecture. They would all welcome the appearance of the lecture in the Press, so as to be able to study it closely at leisure. At the same time there would doubtless be points upon which they might like to question the Professor that evening. His own experience of heated coals and refractory materials had borne out all the Professor had said in a remarkable degree. It was his own unfortunate privilege to have a battery of horizontal-flue ovens and a battery of vertical-flue ovens; and, as all knew, the temperature varied considerably between them. The salt action in the vertical oven was nearly double what it was in the horizontal, showing, as Professor Cobb had pointed out, that a difference of 50° was a very serious thing. Where he could get an oven wall to stand for two years with a temperature of 800°, he could not get it to stand anything like this time with a temperature of 850°. With regard to what had been said about iron. Being disagreed with on many occasions by people in regard to iron, he was glad Professor Cobb had cleared up the question for him.

Mr. T. N. Riley said the subject of salty washing water was one that exercised his own attention largely. In washers where the slack was treated preparatory to entering the ovens, they could not get rid of their circulating water; and as time went on the slack became saturated with salty water. In connection with the washer at his own plant, they were dealing with 500 tons of slack per day, and about 50 per cent. of this went to the ovens. The fresh water they used contained about 0·025 per cent. of salt; the water which was actually in circulation contained 0·18 per cent. The drainage water from the washed coking slack bunkers contained 0·024 per cent., and was conveyed outside the buildings to a drain. It amounted to about 2000 gallons per day. The coal in the ovens, also, contained about 0·02 per cent. of salty water. This salty water was really a point which needed watching, to get free from it.

Mr. T. P. Carr asked the opinion of the lecturer on the use of fire cement with sodium silicate.

Professor Cobb said there was a great deal of difficulty in any case of this sort with the co-efficient of expansion. To secure adhesion with cement was not a difficult matter when the cement was put on while the walls were new; but alterations which took place by the action of the salt on the material of the cement had to be considered—chemically because it might be chemically detrimental, and, physically, because it might so affect the co-efficient of expansion of the applied cement that it would no longer adhere to the wall. This seemed to him entirely a matter of experiment.

Mr. Carr remarked that he was speaking of a wash of the salt.

Professor Cobb replied that he supposed, however, the assumption was that it was going to give a complete glaze. Sometimes it did give a complete glaze. This would be adherent, but sometimes one which was not adherent very long. It was very difficult to get a cement which could be expected to serve for all purposes. He did not say it was not possible; but to give a definite verdict on a subject of this sort would be difficult.

Mr. G. Stanley Cooper said it seemed to him that they had to look upon these questions from two main points of view—the purely scientific view of getting at the cause, and the practical point of view of dealing with it. He had rather expected that Professor Cobb would have dealt more particularly with the practical point of view of overcoming the difficulties. There had been a lot of correspondence in the Technical Press lately as to whether the silica brick or the alumina brick was better adapted for dealing with coal of a salty nature. He was perfectly convinced, personally, that the silica brick "had it;" but he knew there were some present who were just as convinced that the silica brick was "rotten." He personally had to deal with one of the most notably salty coals in this country; and he had found it best to use silica brick. He was also in the unhappy position of experiencing the salty water trouble mentioned by Mr. Riley. They had here a good opportunity of seeing how the silica brick would stand it. There was another point which might have some bearing on the matter, and one which had puzzled him very much, and which Professor Cobb had cleared up. He meant with regard to the temperature factor in the action of the salt on fire-clay material. The temperature at which the brick was exposed played an important part in the ultimate action of the salt on the brick. Some experiments were conducted a year or two ago at Birmingham, and it was shown conclusively that bricks with a higher silica content withstood the action much better than did the lower silica bricks. But there was another factor—a question of temperature—which was not taken fully into account. Above a certain temperature the action of the salt was very much minimized. The higher silica may thereby fail, and, as a coincidence, the lower silica bricks may answer better. Temperature in the flues at Birmingham was generally in the neighbourhood of 200°. The physical structure of the brick was also one of the most important points. The lecturer mentioned having a brick of a close texture to resist the action of salt better. In regard to the action of sodium chloride on the iron, if they took out the mass of common salt before extracting, they could extract a considerable portion of the iron. It had been suggested, he believed, that it was neither the sodium nor the iron, but the chloride. He would like to have Professor Cobb's opinion on this.

Professor Cobb said he was afraid that he must have been misunderstood if he gave any impression that the higher temperature minimized the action of sodium chloride. The point had been that, supposing they put a fire-clay to higher temperature, and the sodium chloride attacked it at that temperature, they would get a glaze formed which was nearly impervious. Even if a coke-oven were worked at a higher temperature, before it reached that higher temperature it had to pass through the lower temperature, and in this lower temperature the action of the sodium chloride which he had described could occur. They were not at that time fused, but being raised to a higher temperature were then fused, or as the higher temperature of the ovens rose.

Mr. J. W. Lee, interposing, said they had understood that the Professor meant a physical change had taken place at the lower temperature.

Professor Cobb said that was so, and a chemical change as well. But this very chemical change which resulted from fusion did not take place until the higher temperature was attained.

Mr. Cooper: But suppose you attain the higher temperature before you introduce the salt?

Professor Cobb said if they did this they would get a soft glazing of the interior of the oven.

The President said, in view of the statements in the lecture, and raised by Mr. Cooper, he would ask what was the possibility of having a glazed brick as an advantage against salt attack?

Professor Cobb said they were there up against the difficulty of the co-efficient of expansion. The glaze—any ordinary glaze which was used—would be cracked off.

Mr. C. P. Finn said he thought the Professor's explanation as to the differences between the glaze and the actual attack of salt on fire-clay in a heated condition could be brought home to those with coke-ovens if they compared the condition of the arches with that of the walls. The arches, although they were covered with a salt glaze, were quite different from the disintegration of the brick itself. As the salt penetrated the brick it got nearer to the actual source of heat—the inside of the flue—and therefore it was reaching a higher temperature, and there was a point at which incipient fusion began to take place. They should compare the glazing of the arches with the actual salt corrosion of the walls.

Professor Cobb, in answer to a question which had been raised by Mr. Cooper, said there was, of course, a difference in the amount of volatilization which took place from various compounds of soda; and sodium chloride was probably the worst in respect of any of the ordinary compounds. But he took it they had to deal with the sodium chloride as it existed there.

Mr. E. M. Myers raised a point with reference to ammonium chloride. There was no doubt that in salty coals the formation of this was governed largely by the amount of chlorides existing originally in the coal. He would ask the lecturer whether the formation of ammonium chloride which took place after the volatilization of the sodium chloride had any bearing on the disintegration of the refractory material.

Professor Cobb said he was afraid he could not satisfactorily answer this question. The presence of ammonium chloride, he had always taken it, was rather to be regarded as indicative of the presence of sodium chloride in the coal originally, so that the formation of sodium chloride was accompanied by the presence of ammonium chloride. But he should certainly trace no connection between ammonium chloride itself and the factors of disintegration.

Mr. Myers said if ammonium chloride were heated in contact with refractory materials, the materials underwent a tremendous amount of disintegration.

Professor Cobb asked under what conditions this occurred. Did Mr. Myers mean in the liquor form?

Mr. Myers: No, salt.

Professor Cobb: Is the salt supposed to be on the surface?

Mr. Myers: Yes.

Professor Cobb said they might, under certain conditions, get a dissociation of ammonium chloride. It was not a matter to which he had given special consideration.

Mr. W. Green said he wondered if an idea which had occurred to him might have any effect, with reference to the production of hydrochloric acid in the coke-ovens. It was usually found that there was also a high content of ammonium chloride. At the temperature existing in the oven, he did not think the ammonium chloride would exist there. With the hydrochloric acid existing there, would it not have an effect on the brick, resulting largely in this disintegration?

Professor Cobb said the question was in substance the same as the one raised by Mr. Myers; and the answer was the same.

Mr. Myers said he did not think there was any doubt that ammonium chloride did not begin to assert itself until it reached the cooler temperature of the hydraulic main.

Mr. A. R. Fleming said Professor Cobb seemed to have entirely cleared up the cases for corrosion due to salty coals. With regard to the *£ s. d.* of the subject, it would appear to him that the limit which they would set before they considered it necessary to adopt special qualities of fire-bricks—the limit of percentage in the coal—should not be over 0·3 per cent. of sodium chloride. Of course, those with a wider experience of different qualities of coal with regard to the salt would no doubt have something to say on this subject as to the limit. He also understood, with regard to the remedy proposed by Professor Cobb, that the idea was to get a fire-brick with a coarsely crystalline silica base, and yet with a fine and coherent surface. But, in addition, the co-efficient of expansion between the large-grained silica base and the fine-grained surface should be practically the same—there should be no wide difference in their co-efficient of expansion. He would suggest whether it should not be possible and advisable, in the case of coal containing a high percentage of salt—say, over 0·3 per cent.—to glaze the surface of the coarse-grained silica brick by means of a very high-temperature flame. That was, actually to make the fine coating on the surface of the brick a fused silica. It would appear to him that in this way they overcame any difference in coefficient of expansion as between the surface of the brick and the inner portions. Of course, it would cost more to treat bricks in this way; but if the coal was very salty, it might be possible that the advantage of having this done would make the ovens last so much longer that the cost would only be a negligible factor as against the advantage derived.

Professor Cobb said the idea seemed quite satisfactory, except from the point of view of the brickmaker. The process of bringing the surface of the brick to the necessary point without breaking the brick, was a practical difficulty of an exceedingly grave character. It would mean that, for the time being, they would have such great local differences of temperature that it would be an extraordinary material that would stand the strain.

Mr. Green asked if they might draw any inference from the case of the American steel facing. Up to the time of adopting this, there had been excessive trouble in the lining of the furnaces; but now they had in use a furnace so treated which had lasted two years, and it might possibly be adopted in the case of coke-ovens, though it might appear a revolutionary idea. In reference to the two coals, there had been instances of more action upon the walls in ovens using low percentage of salt coal than with a coal of high percentage.

Professor Cobb said he should be interested to have the reference to the experiment made with steel-faced bricks. It was quite new to him. As to the curious anomaly mentioned by Mr. Green in regard to the two coals, he was afraid such anomalies were a matter of common experience and were one of the difficulties of dealing with the subject.

The President raised a point as to the amount of dirt in the coal.

Mr. Green said if people would have a chemical analysis of the bricks used and remark as to their appearance and method of using, the Association might be able to build-up data which would help the industry to solve the trouble.

Vote of Thanks.

The President said they had had an exhaustive discussion. It only remained for him to endeavour to express their appreciation of the lecturer's valuable contribution to their records. He moved a hearty vote of thanks to Professor Cobb.

Mr. B. Wilson Haigh, in seconding the motion, said Professor Cobb was an ideal combination of a practical man and a University professor. They would all have much data from the lecture to go upon in getting the right kind of material for settling these awkward problems.

Professor Cobb, in a brief response, said it had not so much been his intention to place before the meeting any complete remedy for the troubles which occurred in the coke-oven industries on account of the salt contained in the coal, as to give what was, in his mind, a view of how these troubles did really come about, because it was essential to understand the nature of the disease before one could work systematically for a complete cure.

[Professor Cobb then conducted the members on a tour of the University metallurgical laboratories.]

EXTRACTION OF BENZOL AND TOLUOL BY AMERICAN GAS OIL AND GREEN OIL.

Mr. John Bond's Experiences with American Gas Oil—Mr. Hubert Pooley's Work with Green Oil.

At the Meeting of the Midland Association of Gas Engineers and Managers, at the Grand Hotel, Birmingham, last Thursday—the President (Mr. C. H. Webb, of Stourbridge) in the chair—Mr. John Bond, of Southport, and Mr. Hubert Pooley, of Leicester, opened a discussion on the subject of the extraction from gas of benzol and toluol. Mr. Bond recounted his experiences with American gas oil, and Mr. Pooley with green oil.

Extraction with American Gas Oil.

Mr. Bond said he should like to thank the Committee of the Association for inviting him to be present that day; and, at the same time, he wished to take the opportunity of thanking the members of the Association who had, through many difficulties, continued the tar-washing of their gas for toluol. The position with regard to toluol was most satisfactory; and the members would probably be pleased to know that about 25 per cent. of the toluol content of the gas was being extracted. He did not want the members to relax their efforts in this direction. But what he wanted to impress upon them more was that the Government required large quantities of benzol—not only for the nation's requirements, but also for France, Italy, and Russia. France was suffering very severely through the loss of the principal coke-ovens in Flanders. This had been a double loss to them, because their loss was the gain of the Germans. He (Mr. Bond) wanted gas engineers to exercise all the ingenuity they could possibly bring to bear upon this subject, and to fit up washing plant for the recovery of benzol. When extracting benzol from the gas at Southport, they did not stop the process of washing by tar—that was worked by the "C" process. First of all they tried creosote oil washing. Unfortunately some of the parcels of creosote oil contained an excessive amount of naphthalene, and this interfered considerably with the gas supply. One parcel of it came charged with about 22 per cent. of naphthalene. He then tried to get a certain amount of anthracene oil, but was not successful in obtaining this. Therefore he turned his attention to washing the gas with Anglo-American gas oil, which at that time he purchased at $2\frac{11}{16}$d. per gallon. He thought the present price was something like $6\frac{13}{16}$d. The method of extracting benzol was very simple indeed; and he would therefore just explain what had been done at Southport, and how they had been able to utilize a certain amount of old apparatus in getting out quite a considerable amount of benzol. The scrubber shown on the diagram was 30 feet high by 8 feet diameter; and it was filled with boards. Oil, which was stored in a tank for the day's requirements, was first of all pumped into a circulating tank, holding about 550 gallons. It was then passed through the distributor at the top of the scrubber, and circulated at the rate of 6 gallons per 1000 cubic feet of gas. It was circulated for six hours only. If they circulated it more than that number of hours, there was a considerable reduction in the benzol, as well as in the toluol. He should be pleased if those interested in the matter would consult the curve [exhibited]; they would see the rapid increase in total products up to 145° C. Also that the benzol curve suddenly decreased after the washing had been continued more than six hours.

Mr. Samuel Glover (St. Helens): Is that in the washing oil?

Mr. Bond said it was. After being pumped round the scrubber for six hours, the "treated" gas oil was pumped into the storage tank at the tar-works. Then it was passed through a Wilton dehydrating coil, on top of which is a small pot containing a steam-jet. The oil passing through the coil at a pressure of 10 lbs. was heated up to a temperature of 110° C.; and they were able at that temperature, with the help of the steam, to get over the whole of

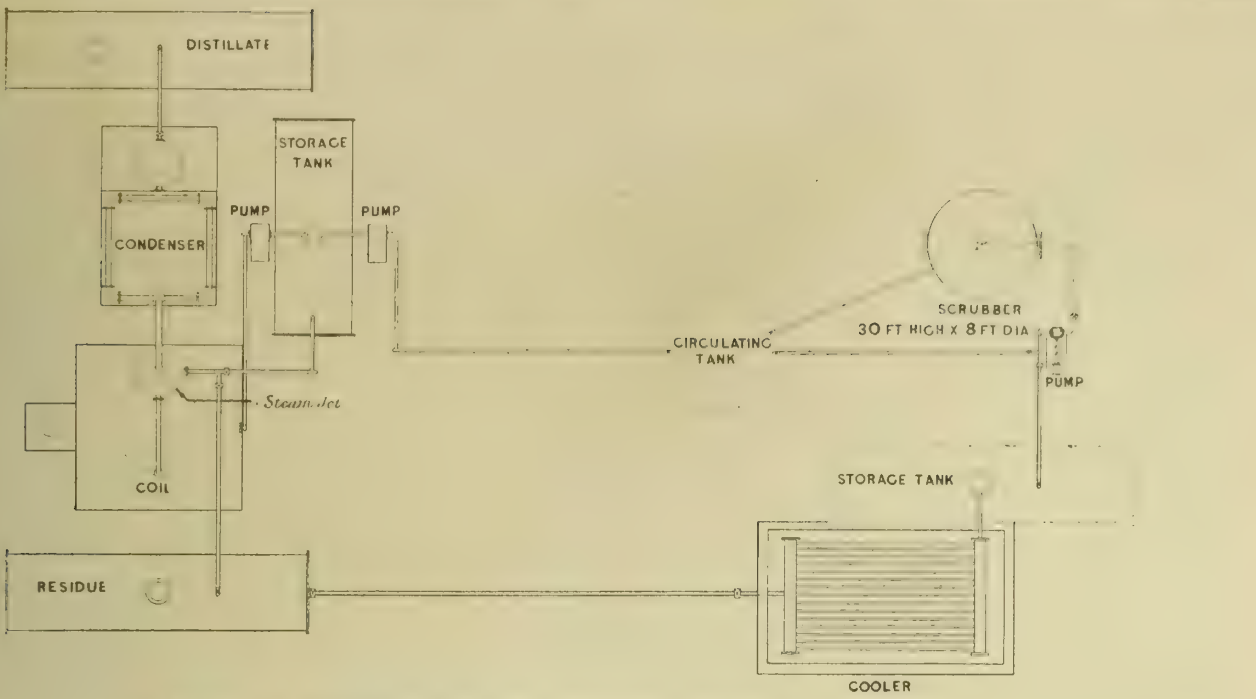
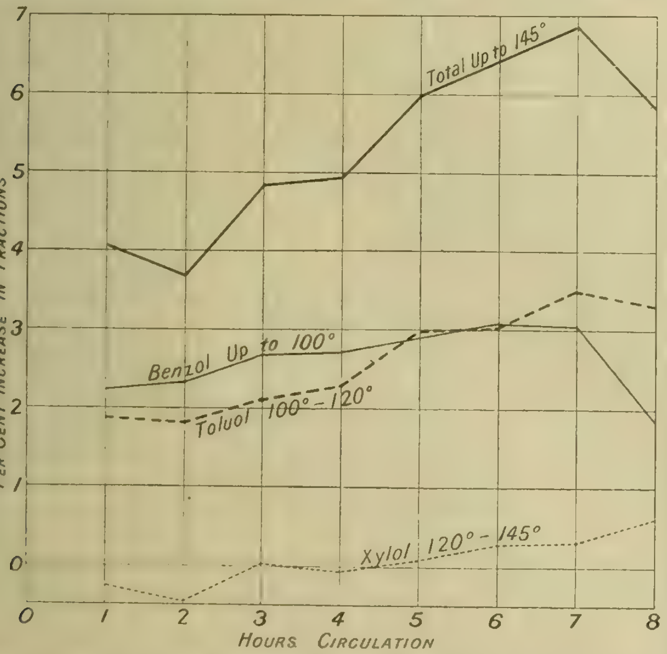


DIAGRAM OF PLANT FOR THE OIL-SCRUBBING PROCESS AT SOUTHPORT.

the crude benzol. The distillate condensed in the small condenser shown on the diagram passed into the storage tank. The residue went forward to a second tank; and after it was cooled, it was passed into the storage tank to be used again in the scrubbers. Perhaps the members would like to know something as to a test of the gas oil used. The specific gravity of it at 15·5° C. was ·859; and the flash point, 125. The first drop came over at 190° C. Up to 300° C., 28 per cent. of the oil came over—leaving a residue of 72 per cent. After using the oil by passing it ten times through the plant, a test was as follows: Specific gravity, ·9025; and flash point, 104. The first drop came over at 158° C.; and there was 27 per cent. of oil up to 300° C.—the residue being 73 per cent. The process of oil washing was intermittent, because the dehydrating coil was used in conjunction with stills for tar distillation. These experiments were started in December; and up to now something like 6000 gallons of crude benzol had been recovered, for which he had received 8½d. per gallon. He thought that, in the majority of gas undertakings, the engineers should consider the advisability of putting down dehydrating plant, because he believed that, in the future, it would be most useful; the rest of the plant could, in his opinion, be constructed in their own shops. He believed that they would as an industry have to take a keen interest in all the products, especially the tar products. At the present time, these were selling at a low figure; but he believed the necessities of the dye industry would have to be largely met by gas undertakings. In this respect, it would be helpful to have some form of dehydrating plant. This was the reason he advised the members to consider seriously the installing of this class of plant. He had a number of tests with him as to the points at which the crude benzol distilled. The whole of the benzol collected from Dec. 5 (when the plant was started) to Feb. 16 contained 75 per cent. of products coming over at a temperature of 147° C. He found on going through the analyses of the gases taken at various gasworks, that the gas contained approximately 10 lbs. of benzol per ton of coal carbonized. In some works, it was less than this amount; in some works, very much higher. But he believed they could successfully recover about 4 lbs. of benzol and toluol apart from the "C" washing process, by judiciously washing their gas with some form of oil, whether it be anthracene oil or Anglo-American gas oil. In his own case, they had recovered approximately 4 lbs. of benzol and toluol per ton of coal; but they had been as high as 6 lbs. By recovering 4 lbs., their illuminating power had been reduced about 2½ candles below the statutory requirements; the standard in Southport being 16 candles. The effect on the calorific value of the gas had not been very great. They had reduced it so far as he had ascertained from 530 to 490 B.Th.U. net. If gas engineers would care to go further into this subject of benzol recovery, or if they came across any difficulties, he would be pleased to get into communication with them, and give any information he possibly could on this most important subject. He did hope that they would seriously consider the matter, so that the nation would be in a position to manufacture the high explosives which they at the present time required.



Circulating Gas Oil through Tower Scrubber—March 15, 1916.

Oil circulated for eight hours through tower scrubber, passing gas at the rate of 75,000 cubic feet per hour, oil circulated at rate of 410 gallons per hour, and samples taken every hour.

Hours' Circulation.	First Drop ° C.	Percentages Absorbed.			
		Up to 100° C.	00°-120° C.	120°-145 C.	Total up to 145° C.
1	54	2·23	1·86	·025	4·06
2	42	2·33	1·81	·45	3·69
3	50	2·68	2·10	·05	4·83
4	56	2·70	2·28	·05	4·93
5	47	2·93	2·96	·1	5·99
6	49	3·08	3·05	·3	6·43
7	53	3·05	3·50	·33	6·88
8	55	1·86	3·31	·65	5·82

Washing with Green Oil.

Mr. Hubert Pooley (Leicester) said he did not think that he could offer to the members in green-oil washing any prospective profits. The process was not an easy one; but he felt that, in attempting to denude the gas of benzene and toluene, they were taking a patriotic step; and it was on these lines he should prefer to preface the few notes he proposed to give. They commenced the "C" process in two of their works in which they had four sections. Quite early, and right throughout the experiments, very poor results indeed were obtained at their large works, where they were producing 4½ million cubic feet of coal gas a day; but, at the smaller works, where rather less than 2½ million cubic feet per day were being produced, very good results were realized. In one section of the large works, they produced only 600,000 cubic feet a day; and in July of last year he decided to collect all the green oil they made, with a view to washing the gas from this particular section. He anticipated—and he was not disappointed—that they would practically denude the gas of its illuminating power; but he intended to pick up with carburetted water gas and reduce the make per ton somewhat in the larger section of the works. They managed to collect by January of this year 16,000 gallons of green oil. He then laid off No. 1 section of the Aylestone works for green-oil washing. Roughly, some 55 tons of coal were being carbonized per day in this section, producing about 600,000 cubic feet, or approximately 11,000 cubic feet per ton. Two washers were arranged after the scrubbers. In the first they washed for naphthalene, using the Colson process; in the second they washed with green oil. They were compelled to take this sequence (which was obviously wrong), as they could only bye-pass the second of the washers. After two washings, and after talking over the matter with Dr. Colman—who was good enough to visit the works after the first remarkable series of washings—he reversed the order of the washers, making some alteration to the connections, and he was now washing for benzene and toluene first, and naphthalene second. When commencing, the green oil had a specific gravity of 1080; and, after twenty-four hours' working, it fell to 1066. In the distillation of the green oil, they obtained the first drop at 78° C.; and up to 170° C. they obtained 7·7 per cent. This washing was carried on for 144 hours, at the end of which time the specific gravity of the oil was only reduced to 1056; and the total distillate below 170° C. was only 13·4 per cent. From this he was able to judge that the first twenty-four hours was the richest period in result. So far as they were concerned, it was not a difficult matter to isolate one section of the works, and to pull up the candle values to a point. But a considerable time elapsed before they could collect sufficient green oil to commence working; and if any attempt were made to wash generally with green oil, there would certainly be a great shortage in the supply of material. Where flat-flame burners were used, the greatest possible inconvenience would be felt by consumers. Experiments on similar lines might be conducted in other works where the manufacture was divided up into sections—laying off one or more sections for the particular purpose. The results of green-oil washing were that they produced per ton of coal 13·6 lbs. of benzene and 5·28 lbs. of toluene. These results were very remarkable; and Dr. Colman came along to see if he could find any difference. His test showed 13 lbs. of benzene, and 3·9 lbs. of toluene. There was thus a large difference in the toluene content between Dr. Colman's figure and their own. A discrepancy was discovered in the thermometers used, which accounted to a certain extent for some of the difference. Unfortunately, there was no more of the original sample left. In the second charge, the results were not so good. His assistant responsible for this section of the works did not carry on the washing quite to his instructions. His instructions were that the washing should be continued until the gravity of the green oil was reduced to 1065. The mistake was made that the hard-and-fast rule was set to the workmen that they should wash for twenty-four hours. The green oil only tested 1076 at the end of the time. The result was that they obtained 7·18 lbs. of benzene and 1·98 lbs. of toluene. After this they improved; and he thought that he could give the results better in another way. The green-oil washing was proceeded with throughout seven periods of twenty-four hours. The average quantity of gas washed was over 600,000 cubic feet; and the make approximately 11,000 cubic feet per ton. He would give the series of benzene and toluene results in gallons taken from the total quantity of gas—600,000 cubic feet being the quantity for each series:

Approximate Gallons Taken from the Gas.

	Benzene.	Toluene.	
	76	28	
	42	12	
	105	34	
	64	8	
	41	10	
	38	18	
	72	12	
	438	122	Total benzene and toluene, 560 gallons.
Average	62·5	17·4	79·9 gallons. per washing.
Taking 61 tons of coal, average per ton of coal	1·02	0·28	1·30 gallons. per ton of coal.

From the washings this was equal approximately to 9 lbs. of benzene per ton of coal and 2·7 lbs. of toluene. The results were exceedingly encouraging. His greatest trouble was that they were forced to work intermittently. It took them about twenty-four hours to change their washers, and in this respect the system of working was not satisfactory. If they could lay-off a second section of the works and get continuity, it would be better; but the effect on the calorific value and illuminating power of the gas was such that he could not see his way to go farther at present.

Further Information and Interrogation.

Mr. J. Ferguson Bell (Derby) said the members would desire to tender their thanks to Mr. Bond for giving them such an interesting statement regarding the recovery of benzol and toluol by American gas oil. They were glad to know that the efforts of the gas industry, supplemented, of course, by the coke-oven industry, had been the means of enabling the Government to overcome the shortage of toluene. He was quite certain that the gas industry, which responded so willingly to the desire of the Government for supplies of toluol, would be equally emphatic in respect of benzol. He should like to tender to Mr. Bond his personal thanks for the information he had been good enough to give him in respect of this interesting process that he had worked out at Southport. There was no doubt that the gas industry in future would have to turn more attention than in the past to the profitable utilization of the residual products, and to the supply of gas of a lower illuminating power and of possibly a lower calorific value than had now to be given, and which would be found equally to the advantage of the consumers. In the future, after what was now being done, they would no doubt be able to convince Parliament that candle power was unnecessary, and that a calorific value of something like 500 B.Th.U. was all that was required. The figures given by Mr. Bond were most remarkable. He took it that he extracted something like one-third of the benzol and one-third of the toluol, and that the reduction in candle power was from 16 to 13½ candles, tested by the No. 2 burner. The 13½ candles was, of course, a good illuminating power; and he thought that in the future they would be able to easily come down to about 12-candle power, and satisfy all their consumers, even those who still persisted in using flat-flame burners, and who were now in the minority. The reduction of B.Th.U., he understood, was from 530 to 490 net. He believed Mr. Bond said he used the washing oil ten times.

Mr. Bond: We have now circulated it until it has been used twenty times. The test was for ten times.

Mr. Bell said it was his intention to introduce the process, and there were many other members who would want to do the same. Mr. Bond would therefore, he was sure, be pleased to give information. He (Mr. Bell) would like to know what was the loss of oil. He took it there would be some loss. Mr. Bond started with 450 gallons; and of this, what was the proportion of loss?

Mr. Bond: On Dec. 5, we had 3720 gallons of the original gas oil; we have now 3200 gallons. So you see there is very little loss, especially when one considers that the oil has been used for a large number of experiments. By way of recovery of debenzolized oil, we get 95 per cent.; and in the first few weeks such percentages as 88, 90, 86·5. So that there is practically no loss in oil.

Mr. Bell: So you can keep using the oil again and again.

Mr. Bond: It has kept well up to now—that is, up to twenty times using. If it ceases to take up benzol or toluol, then I intend to put it through the carburetted water-gas plant.

Mr. Bell remarked that the loss in calorific value was about 40 B.Th.U., or 6 per cent. With respect to Mr. Pooley's paper, they were interested to know of the results that he had been good enough to indicate to the Association. He had, however, convinced most of them that they could not go in for washing their gas with green oil. Mr. Pooley stated that he got an average of 9 lbs. of benzene and 2·7 lbs. of toluene per ton of coal, which were extremely high figures. But he did not tell them how much he denuded his gas of its illuminating power, and what was the reduction of calorific value. He took it that what Mr. Bond suggested was that they should take out as much benzol and toluol as they could, and still give the consumers a gas that they, as gas suppliers, could fairly distribute—say, a gas coming somewhat below 12 candles.

Mr. Bond said he should advise that the reduction be done gradually. He did not think it would be good policy to reduce by 4 or 5 candles straight away. At the start, at Southport they reduced the illuminating power by 1 candle, and now they had reduced it by 2½ candles. Finally, he believed they would get down to about 10 or 11 candles; but they would go steadily at it. He did not intend, unless absolutely forced, to comply with the statutory regulation in this regard in the future. This was his position: His Corporation had spent a considerable sum of money over this process; and, of course, they could not recover the money now, because they were doing all they could to get the products that the Government required. Naturally, he should expect to make this good after the war. Therefore, he contended that if the consumer was satisfied with 12-candle power gas, and if they could show the consumer how to use it, then the proposition was a simple one—that was, to continue the supply of the 12-candle gas instead of 16-candle gas. [Laughter.]

Mr. Bell said that he agreed with Mr. Pooley that there was no money in the process he had brought before them. But they did not want to make money out of it during the war; they were quite willing to do all they could to give the Government as much benzol and toluol as possible—whether it paid the gas-works or not. That was a secondary matter; and they were all patriotic. They knew, too, that France required benzol very badly; and they must make what they could for this country's Allies. Mr. Pooley said that his gas was washed through a washer with green oil. Was that a Livesey washer?

Mr. Pooley: Yes.

Mr. Bell said extracting such a large quantity of benzene and toluene from the gas as Mr. Pooley had mentioned, the effect must be very drastic in respect of illuminating power and possibly calorific value. Mr. Pooley also pointed out that there would be some difficulty in getting green oil; and, so far as that went, there was some difficulty in getting American oil at the present time. The price of 6d. per gallon was not ruling now; it was something like 50 per cent. higher. He had a quotation at 8¾d. two or three days ago; but it was withdrawn that morning.

Mr. Samuel Glover (St. Helens) asked whether they might seek a further favour of Mr. Bond. Those who were thinking of applying such a process as this, would welcome an opportunity of spending a little time at the Southport Gas-Works in order to investigate it. Would Mr. Bond welcome deputations of engineers who desired to go further into the details?

Mr. Bond said he should be glad to receive any number of deputations to see the process. Also if any engineer would like to send over his chemist, they would be pleased to let him have the use of the laboratory, and conduct a number of tests along with their own chemist.

Mr. Glover said that some of them would leave the meeting fully satisfied that they knew where to go for further details of the process. This system of washing with petroleum oil was very applicable to works where there was some sort of tar distilling or oil distilling plant in the first instance; but, in the case of the managers of works where there was no tar-distilling plant, they could put down some simple extension of the process, and the petroleum oil, or the green oil (when it could be obtained), could be easily and readily distilled on the works by means of this simple apparatus.

Mr. Bond said that any of the tar dehydrating or refining plants could be used. He thought they could go further, and, if they could not get the necessary plant at once, they could build-up a simple form of dehydrating plant for the purpose.

Mr. Glover said that this cleared up another point, that it did not depend upon having on the works a tar-distilling plant, seeing that a simple plant could be put down for the repeated re-distillations of the washing oil. Mr. Bond had also cleared up the point as to what would become of his washing oil when he got sick or tired of washing gas for benzol or anything else that he wanted to take out of it. The process was, Mr. Bond's remarks showed, very applicable to works with carburetted water-gas plant.

Mr. Bond: With regard to washing with green oil, Mr. Pooley's results varied somewhat (they depended upon the conditions under which the washing was done); but his success could be repeated by anyone who got some green oil, and used the very simple process to extract the benzol which was so much desired for the nation's use at the present time. Both processes were worth consideration in the present circumstances of the country.

Mr. George Stevenson (Long Eaton) said he had been looking up the results of some tests that he had made, and which corroborated Mr. Pooley in one particular. Mr. Pooley said that, with his washing process, he obtained 2·7 lbs. of toluene per ton of coal. At Long Eaton, an experiment showed 2·96 lbs.; but after introducing the limestone process, this was increased to 3·84 lbs. The figures closely approximated Mr. Pooley's; and they showed what could be got if they were prepared to eliminate illuminating power entirely.

Mr. Pooley: Was yours per ton of tar or per ton of coal?

Mr. Stevenson: Per ton of coal.

Mr. George Helps (Nuneaton) said he was very interested in the experiments these gentlemen had made. He was told that he was talking nonsense when, some three or four years ago, he spoke about getting down to a calorific value of about 300 B.Th.U., and no illuminating power. This work about which they had been hearing pointed to the fact that he was not then talking so much nonsense as he even then thought he was doing himself. [Laughter.] At that time Mr. Bond and some of their friends talked of 600 B.Th.U., and 18-candle gas; and now Mr. Bond was speaking of 10-candle power, and of 490 B.Th.U.

Mr. Bond: I should have got down before, had it not been for the statutory requirements.

Mr. Helps: That is the road we are going to take; and when we get down to 300 B.Th.U. and no illuminating power, we shall be able to sell gas at such a low price that people can afford to use it.

Mr. C. H. Carder (Oldbury), referring to Mr. Bond's proposal to dispose of the spent gas oil in his carburetted water-gas plant, asked what was the effect on the sulphur content of the gas oil. His carburetted water-gas purifiers were hardly large enough now for their work; and he did not want to overload them by adopting some process that would quite likely increase the sulphur content of the gas.

Mr. Bond replied that he had not tested the gas oil for sulphur; but he could readily have the test made, and would furnish Mr. Carder with the results in about a week's time—perhaps less.

Mr. Samuel Glover: The sulphur content would be proportionately variable with the length of time the gas oil lasted. It might be that there would not be any need to use the oil in the carburetted water-gas plant, and then there would be no question as to recovering the sulphur again.

Mr. Thomas Berridge (Leamington) said the matter that had frightened most of them in connection with these processes was the reduction of the illuminating power. They had already had, through working with the "C" process, a great deal of trouble in regard to illuminating power; and he had the additional difficulty of more naphthalene. He had all the apparatus Mr. Bond had referred to which he could put up quite easily; but while he claimed to be perfectly loyal, and anxious to do all he could for his country, he really did not think he dared do more than he was doing now—there would be such a big row all over the town. Owing to the lighting restrictions, and the early closing of the public houses, they had a reduction of about 20 per cent. in their output. It seemed to him the Government did not help them so much as they might do. They ought to pass an Act of Parliament, and give some assurance that they would protect the gas industry. Customers were being lost; and there was no doubt they were going over to the electric light, and it was a question whether they would get them back again. His illuminating power was down now to about 14 candles; if he reduced it to 12 candles, he believed it would practically half-ruin them.

Mr. Bond: A very neat pamphlet has been got out by the British Commercial Gas Association for distribution among consumers. You should distribute it in your district. It has had a good effect in Southport.

Mr. Berridge said the consumers would not read it. If gas undertakings were compelled by law to do this work, then they would have to do it; and they would get a little more protection from the Government than they had at the present time. One was quite anxious to do all one possibly could; but there was need for more protection.

Mr. B. W. Smith (Walsall) sympathized somewhat with what Mr. Berridge had just said. There was some fear that electricity undertakings would take advantage of this lowering of the illuminating power of the gas; and there were no means, except by the circulation of literature, to defend one's concern. The difficulty was to get people to read the literature. With regard to illuminating power; its reduction to a much lower point was all very well for those whose consumers used incandescent burners entirely. In his case, they had a large number of consumers in the leather trade who employed flat-flame burners. The Ministry of Munitions stated that those who had flat-flame burners ought to know better, and ought to use incandescent ones. He had done all he could to impress upon consumers the importance of the change—not only in view of money economy, but in view of the improvement of light. The difficulty was, with any interference with the illuminating conditions of the gas, to prevent customers going over to electricity. In reference to the matter of scrubbing as introduced by Mr. Bond, might he ask why he placed his washer first? His (Mr. Smith's) works were differently arranged. In his case, he used a Livesey washer for tar washing, he then used a pre-benzolized creosote washer for naphthalene, then he went on to a tar-washer to take out the tar, and then the gas went into a Holmes washer for ammonia. Where in this case would Mr. Bond place his scrubber?

Mr. Bond: The tar-washing process in my case takes place after the condensers in a Livesey washer; then the gas goes through a Pelouze-Audouin tar-extractor, into a Holmes washer (which removes the whole of the ammonia), and immediately after comes the scrubber to which I have referred.

Mr. Smith: That is next to the inlet of the purifiers.

Mr. Bond: Yes. You mentioned naphthalene. The oil takes up a considerable quantity of naphthalene; and we have not, since using this process, had more than about 5 grains of naphthalene per 100 cubic feet at the inlet of the purifiers. Therefore a reduction has taken place in the naphthalene content of the gas at the outlet of the governors.

Mr. Smith: Through absorption by the oil; so that you increase the naphthalene content of the oil.

Mr. Bond: It is increased.

Mr. Smith: What are you going to do with the naphthalene, seeing you dilute your oil with that quantity of naphthalene?

Mr. Bond: It comes over with the distillate. We then sell the distillate as crude benzol; and the tar distillers deal with it afterwards. We considered erecting a benzol-refining plant, but found it was not worth while for the amount which could be recovered.

Mr. Smith: The process would mean installing a new washer.

Mr. Bond: Perhaps you would have enough washing power to spare a washer—at any rate, in the summer months.

Mr. Smith: We could perhaps in one section.

Mr. E. W. Smith (Birmingham) said he had been intensely interested in hearing the description of the two processes for crude benzol extraction. Perhaps a reference to some of the results obtained on the coal-test works, and also on the complete washing plant at Nechells, might prove of interest to the members. When the plant at Nechells was first started up, American gas oil was used as the wash oil. This was changed to creosote, largely owing to the toluol produced containing too high a percentage of paraffins. This objection did not hold for benzol washing. Mr. Bond had given them some very satisfactory figures for the recovery of crude benzol by means of gas oil. Did these quantities contain any wash oil? In their case, they found that the crude benzol contained as much as 20 per cent. of wash oil; but the temperature of distillation was 120° C. with steam, as against Mr. Bond's figure of 110° C. Mr. Bond would be interested to hear that the creosote initially contained over 30 per cent. of naphthalene. When taken out of circulation at the end of five months, it contained 5 per cent.; the creosote having been separated in the cooling tanks and sold. This creosote after four months acted quite satisfactorily, although it had been through the stills over 360 times. At the point of washing, there was no tar in the gas. The crude benzol contained about 8 per cent. of spirit which distilled over before the benzene. This was termed "foreshots" or "pre-benzol." It contained about 1·5 per cent. of sulphur, and was returned to the gas as an enricher. On the coal-test works they had had a plant running very similar to that described by Mr. Bond. It consisted of three towers filled with hurdles, and four 400-gallon tanks, each filled with wash oil. Each tower and one tank worked separately from the rest—the wash oil returning to the same tank. The three towers worked for the gas in series, and when the oil in the first (gas) tower reached 5 per cent. saturation of crude benzol, the tank of oil was taken out of circulation for distillation, and the oil in the remaining tanks moved one tank—or tower—forward. The cooled debenzolized oil was then used in the third tower. This process was continuous and entirely successful. In connection with these tests he tried using a Holmes washer, and, as each bay was really a separate washer, oil was hourly extracted from each bay. It was found that this oil became saturated—under their conditions of temperature and gas concentration—when the crude benzol content reached between 5 and 6 per cent. On continuing the washing in all the bays, it was noted that the crude benzol in the first saturated bay consisted of a large proportion of benzene and smaller proportions of toluene and xylene. On further use, the benzol was displaced by toluene, &c., until absorbed in subsequent bays. By this means, by adding 5 per cent. of benzol to the wash oil, it was possible to completely wash-out the toluene, which displaced benzene, and the quality of the gas remained approximately the same. This work threw some light on Mr. Bond's point that, after a certain stage was reached in continued washing with the same oil—without distillation—the wash oil appeared to lose benzene.

Mr. Bell proposed a hearty vote of thanks to Mr. Bond and Mr. Pooley for introducing these particularly interesting topics for discussion.

Mr. Berridge seconded the motion, which was cordially passed.

Mr. Bond thanked the members most sincerely for their vote. It had been a great pleasure to him to meet the members of the Midland Association once more. With regard to the questions that had been put to him, he thought he had covered most of them; but if any member wished for further particulars, and would write to him, he would be pleased to give him all the information in his power.

Mr. Pooley said he should also like to thank the members for their kind vote. There was only one question he had not answered. That was the one Mr. Bell addressed to him as to the illuminating power and calorific value. In his opening remarks, he stated that they pulled-up the illuminating and calorific power by means of the water-gas plant, and by lessening the make per ton in the second section at the Aylestone Road works.

TOLUOL AND THE LIMESTONE PROCESS.

By George Stevenson, of Long Eaton.

[A Paper presented to the Midland Association of Gas Engineers and Managers, March 23.]

At the request of our President, the author has pleasure in submitting a short note of experiments which have been made with the above process at his works during the past eight months.

There is nothing new in the use of a mixture of lime and coal for carbonization; for so long ago as 1882 Cooper was granted a patent which claimed by the use of lime:

(1) An increased yield of ammonia from the coal.
(2) An increased yield of gas or tar.
(3) A reduction in the impurities.
(4) An improved coke.

No claim was made specially for an increase in the hydrocarbon content of the gas. Probably, the purification value of the process was the great attraction, as at that time the sulphur clauses were rigidly enforced, and gas undertakings were ready to investigate any new method which gave promise of help in this connection. The main practical difficulty, however, was the absence of an arrangement for the thorough mixture with the coal, as the powdery nature of the quicklime caused much trouble. In many cases, where no machinery was used, and consequently the coal was not crushed, it was not possible to effect the desired mixture.

On the whole, the process seemed to fall away until Mr. R. O. Paterson (an esteemed Past-President of the Association) devised and patented a method of mixing which overcame all the difficulties. Mr. James Paterson, M.A., favoured the gas industry with a very interesting and complete account of the Cheltenham experiences, in a paper he read before the Southern Association of Gas Managers on Nov. 9, 1911. I refer those interested to this paper and the useful discussion which followed.

After the repeal of the sulphur clauses in the South Metropolitan Gas Company's Act, and the consequent general acceptance of the principle of freeing gas undertakings from obligations of this nature, the main objects of the liming process naturally aroused less interest; although the advent of keener commercial conditions compelled some of the most far-sighted undertakings to voluntarily reduce the sulphur content of their gas. It must be admitted that these pioneers were right, that their policy is abundantly justified, and all gas managers are agreed as to its great importance.

Experiences at Long Eaton.

Having thus digressed on historical grounds, I come to our own experiences. In the summer of last year, when the "C" process was inaugurated, many of us began to test for our own results; and not a few of us were surprised to find how little was known about toluene by coal-gas engineers. At our own works, we were disappointed to find with our ordinary system of working a very small amount of toluene in the tar. It was realized that this toluene content of tar would vary in each works according to the class of coal used, the temperature of carbonization, the efficiency of washing, &c.

The process as now under review, and comprised in patents No. 18,744 of 1911, &c. [see "Journal" for April 16, 1912], was brought to our notice; and, though primarily intended for coke-ovens, it was resolved to try it, rather than modify our existing working. One object only was sought—viz., an increase in the recoverable hydrocarbons in the gas and tar.

The process, which is designed specially for low-grade semi-coking coals, consists in the admixture of a definite percentage (according to the analysis of the ash in the coal) of finely-ground limestone; and for effective working the coal must be crushed, and the mixing constant and regular in quantity.

It is claimed by the patentees that the action of limestone is entirely different from that of burnt lime, in that "the limestone, when intimately mixed with coal rich in hydrocarbons and with a high oxygen content, commences to decompose at a temperature lower than that of the resinous and other matters contained in the coal, and that the actions taking place slightly retard the evolution of the gases generally given off so freely with low-grade coals, and this allows of their becoming more stable."

The author does not necessarily subscribe to the theoretical claims made for the process, and in these strenuous times, when there is perhaps far too much talking, practical results are of more consequence.

Methods of Mixing the Limestone.

Our first efforts were directed to secure admixture by the construction of a receiving hopper, in which was fixed a rake-mixer, driven by a worm-gear from the main shaft of the De Brouwer projector; the bottom exit for the limestone being effected through a horizontal sliding door connected with the lever operating the coal from the hoppers. A subsequent improvement was the introduction of a 1 H.P. motor for arriving at the required speed. By this means, a regular and definite quantity of material was introduced with the coal into the grooved pulley of the projector.

However, the gritty nature of the limestone gave constant trouble; and it was decided to feed the required quantity of material evenly on the top of the coal-waggons in the siding—the waggons, having bottom doors, emptying into a breaker, and the coal and limestone being elevated into overhead bunkers in the usual way. Experience has proved that this simple method gives perfect admixture.

Important points to note are that the coal must be small, and preferably densely charged; so that when mixed with the limestone a good surface contact may be ensured.

The limestone in our case is pure mountain quality—practically pure calcium carbonate; though a limestone containing a definite percentage of magnesia may be required in other cases for accelerating the evolution of vapours, instead of retarding them.

The sizing of the limestone is all-important. If this is too large, the coke is badly pitted.

Various criticisms (many from those who have no practical experience) have been made against the process. The chief of these are:

(1) That the limestone is an inert substance, and has no chemical or physical action on carbonization.
(2) That the quality of the coke is adversely affected.
(3) An alleged increase in stopped ascension pipes.
(4) Excessive clinker in the furnaces.

It is not the intention of the author to contest the theory of the first point, but that some action takes place is proved by the following tests:

Date, 1915-16.	Number of Test.	Description.	Pounds per Ton of Coal.	
			Toluene.	Benzene.
Sept. 3 . . .	1	Untreated tar	0·096	—
,, 3 . . .	2	Washed tar	0·50	—
,, 17 . . .	3	Limestone washed tar	0·73	—
Nov. 29 . . .	4	Washed tar	0·48	1·26
Jan. 6 . . .	5	Limestone washed tar	1·24	2·49

The tar is apparently completely altered in character—being more oily; and if there is no beneficial action, it may be asked how otherwise these improved results have been obtained?

In this connection attention is directed to Dr. Lessing's lecture on "Catalysis" [see "Journal" Sept. 8, 1914], and articles in the "Journal" and "Gas World," and a useful book on "Catalysis," by E. Jobling, published by Messrs. J. & A. Churchill.

As to the quality of the coke, it may be remarked that one of the prime objects of the process is the improvement of the coke, which from these coals with ordinary carbonization is generally soft and friable. In our experience the coke is greatly improved and is being freely used for the most exacting purposes.

We have an almost complete immunity from stopped pipes.

The furnace clinker, admittedly, is harder, but not seriously so.

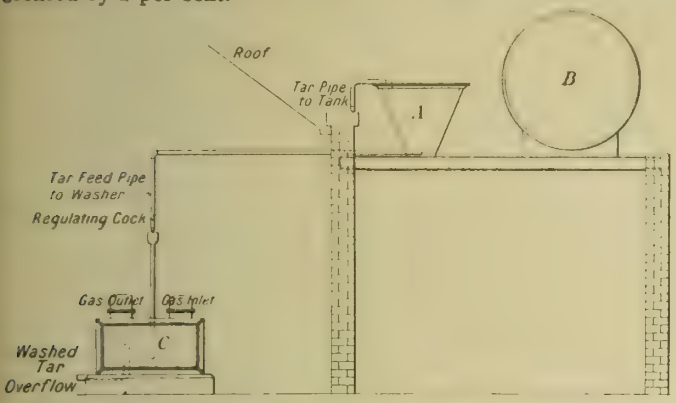
As arranged with our President we have just completed two practical tests—viz., one week's total carbonizing with and without limestone admixture. The results are given in Appendix A; and the following are observations thereon.

Effect on the Gas.

There was a small increase in both the quantity and calorific value; but no tests were taken of the lighting power. The flat-flame burners were, however, distinctly better with the limed gas; and the analysis for olefines, &c., corroborates this. The naphthalene was reduced; and we were free from complaints except from the gas without limestone when stoppages occurred in the district. The most marked advantage was the great reduction in the total sulphur content of the gas. These sulphur tests were checked and rechecked; and, bearing in mind the fact that only one ascension pipe is used, the result may be described as remarkable, and perhaps worth the whole of the trouble and total cost. The claim that the gas would be given off more regularly was not sustained, although laboratory tests were quite favourable to this theory.

EFFECT ON THE COKE.

Samples are submitted of the limed coke. There was a small reduction in the quantity of breeze; and the ash content was increased by 2 per cent.



A. Feed Tank for Tar to the Livesey Washer—450 Gallons Capacity.
B. Overhead Liquor Tank to Sulphate Plant. C. Livesey Washer.

Arrangement for the "C" Washing Process at Long Eaton.

EFFECT ON THE TAR.

As expected when changing over to liming, the tar was found to be much thinner and more oily. A slightly increased yield was noted. The toluene content was greatly increased; and it is only fair to refer to the great difference in atmospheric conditions prevailing during the two weeks. In the first week (without limestone) the temperature was exceedingly low, and the result bears testimony to the efficiency of the washing arrangements.

Cost of Working.

7 tons 4 cwt. limestone at 10s.	£3 12 0
Labour, mixing	1 5 2
Royalty at ½d. per ton of coal	0 10 2
Cost per ton of coal, 5·27d., or 0·45d. per 1000 cubic feet	£5 7 4

On the credit side is 280 cubic feet of gas per ton of coal at 1s. 6d. per 1000 cubic feet, £5 2s. 8d.

Other items not assessed in money are: Great reduction of impurities; improvement of coke; reduction of breeze; freedom from naphthalene troubles; increased tar production; increased tar value. The net result of this test proved that the increased quantity of gas alone paid the whole of the cost.

CONCLUSION.

In conclusion, it may fairly be stated that the claims of increased hydrocarbons in the gas and tar, by means of the limestone process, are generally sustained, and excellent results have been attained and recorded. The many and various changing phases of carbonization and the complexity of all tars add to the difficulty of any certainty in the ultimate results from coal-gas works, although further experience may establish some definite lines of practice which may lead to final general success.

APPENDIX A.

Carbonizing Tests at the Long Eaton Gas-Works, March, 1916—New Hucknall and Bentinck Coal and Pinxton Nuts.

—	March 1 to 8 Without Limestone ("C" Washing).	March 10 to 17 With Limestone ("C" Washing).
Number of charges	446	446
Coal carbonized	247 tons 3 cwt.	244 tons 10 cwt.
,, per 12-hour charge	11·08 cwt.	10·96 cwt.
Gas made	2,924,000 cubic feet	2,963,000 cubic feet
,, per ton of coal	11,838 cubic feet	12,118 cubic feet
Average gross calorific value	531 B.Th.U.	536 B.Th.U.
Calorific value per ton of coal	6,285,978 B.Th.U.	6,495,574 B.Th.U.
Average composition of gas—		
Carbon dioxide	2·2 per cent.	3·1 per cent.
Olefines	3·5 ,,	4·6 ,,
Nitrifiable compounds	0 3 ,,	1·3 ,,
Oxygen	0 7 ,,	0·6 ,,
Carbon monoxide	8·9 ,,	9·6 ,,
Sulphur	25 grains per 100 c. ft.	13·9 grains per 100 c. ft.
Naphthalene	7·6 ,, ,,	6·6 ,, ,,
Coke made	152 t. 1 c. 3 q.	145 t. 15 c. 2 q.
Breeze made	41 t. 1 c.	36 t. 2 c. 2 q.
Coke saleable	115 t. 15 c. 2 q.	114 t. 3 c.
Coke saleable per ton of coal	9·37 cwt.	9·33 cwt.
Coke used in furnaces	36 t. 6 c. 1 q.	31 t. 12 c. 2 q.
Coke used in furnaces per 100 lbs. of coal carbonized	14·7 lbs.	12·93 lbs.
Breeze used in furnaces	9 t. 16 c.	7 t. 17 c. 3 q.
Breeze used in furnaces per 100 lbs. of coal carbonized	3·96 lbs.	3·22 lbs.
Breeze used for boilers	31 t. 5 c.	28 t. 4 c. 3 q.
Total coke made—percentage on coal carbonized	61·53 per cent.	59 62 per cent.
Total breeze made—percentage on coal carbonized	16·61 ,,	14·77 ,,
Total residuum	78·14 ,,	74 39 ,,
Quantity of tar made	2670 gallons	2695 gallons
Quantity of tar made per ton of coal	10·8 gallons	11·02 gallons
Specific gravity	1·190	1·184
Water	3·65 per cent.	3·72 per cent.
Distillates 0° to 145° C.	4·84 ,,	5·51 ,,
,, 145° to 170° C.	0·97 ,,	1·81 ,,
Toluene per ton of coal	0·941 lb.	1·409 lbs.
Benzene per ton of coal	1·563 lbs.	2·459 lbs.
Average temperature of tar and washed gas	40° Fahr.	50° Fahr.

APPENDIX B.

Coal used: New Hucknall and Bentinck coal and Pinxton nuts. All coal, coke, and breeze carefully weighed over weighbridge.

Tar separately collected in a special tank. Tar for washing gases separately measured and sampled.

Rate of washing: As made.

Calorific value of gas determined by average of systematic and constant tests day and night. Recording calorimeters on "make" and "town" throughout test.

Retorts 23 inches by 16 inches by 20 feet, segmental section, regenerator fired, and filled by De Brouwer projector.

Average temperature in retort, 1180° C.

REINFORCED CONCRETE FOR WATER-WORKS.

It was pointed out by Mr. Charles F. Marsh, M.Inst.C.E., in a paper which he read before the Concrete Institute, that in the construction of works specially required for the purpose of the conveyance and storage of water reinforced concrete can be usefully employed for many purposes. The chief uses for this material are the construction of dams for impounding water, of aqueducts and pipes for its conveyance, and reservoirs and tanks for its storage. There are also many works of an incidental nature for which it may be employed, among which are retaining walls, bridges, slope coverings, buildings, fencing, and sundry other structures of various descriptions essential for the completion of any large system of water supply.

He remarked that the concrete used for structures which must resist the pressure of water should be richer in cement than that employed for the generality of structures. For reservoirs, tanks, and dams, where there is sufficient thickness, the concrete should be mixed in the proportions of 1 : 1½ to 3, or 810 lbs. of cement to 13½ cubic feet of sand and 27 cubic feet of broken stone or shingle, which mixture is sufficiently water-tight for any but very considerable heads. But for pipes and structures of small thickness (say less than 3 inches), a mortar mixed in the proportions of 1 to 1½, or 1620 lbs. of cement to 27 cubic feet of sand, should be used.

For pipes under pressures exceeding about 40 feet some special lining should be used. For any structure which has to resist the percolation of liquids, it is advisable to mix a waterproofing compound with the concrete, or to otherwise provide against leakage by the use of a soap and alum wash, paraffin wax, or other suitable protective coating. For increasing the imperviousness of concrete or mortar, ordinary hydrated lime has been used very successfully, and appears just as effective as any of the patent compounds on the market. It can be used in proportions up to 10 per cent. of the weight of cement without injuriously affecting the strength of the mixture; but 5 per cent. is sufficient for any ordinary purpose.

The concrete should always be kept damp for some time after moulding, depending on the richness of the mixture. The period in the case of a 1 to 1½ : 3 mixture should be about two weeks. In structures of considerable length, which may be alternately wet and dry, and are exposed to variations of temperature, it is advisable to provide against cracking, which is almost certain to occur. Such structures should have specially constructed contraction joints not more than 30 feet apart; leakage being prevented at the joints by the insertion of sheet lead or copper baffles extending well into the concrete on each side of the joint, and bent over at the extremities to form a good key. In the construction of all structures to resist the pressure of liquids, special care is necessary to provide adequate reinforcement against shrinkage due to the setting of the concrete, fall of temperature, and excessive dryness.

When reinforced concrete is employed for the construction of dams, they are usually of a hollow form of construction, having up-stream and down-stream slabs supported on cross walls carried upon a foundation slab. From the foundation slab, a core wall must be carried down under the bottom of the up-stream slab, and extended well into a water-tight stratum. The provision of an adequate cut-off wall is most essential, as some of the dams already constructed of this material have failed owing to the neglect of this precaution. The up-stream slab is generally constructed with a flat slope not steeper than 1 to 1, since the flatter the slope the more uniform is the pressure on the base.

The base slab of a hollow dam is generally formed with holes to allow any water which may gain access under the dam free vent, and obviate any tendency to lift. The water percolating through the base slab is discharged under the bottom of the down-stream slab to the stream below the dam. The crest of the dam is formed of such shape as will accommodate the flow of the greatest height of flood which will be allowed to pass over without the formation of a vacuum under the overfall. The down-stream slab is generally constructed of a considerably flatter slope than that usual for solid masonry dams; and the water is consequently conducted to the stream below the dam with less velocity, and with a more even flow. This slab frequently terminates before reaching the base of the dam, allowing free access for the water to and from the interior, or sufficient holes are left at its base to effect the same object. The cross walls or buttresses are stiffened by longitudinal beams, and may be formed with openings to economize material and give means of access. There is usually a passage-way through the dam from end to end, and frequently several at various depths. The gearing for the outlet and scour valves may be actuated from these passage-ways. Dams, when of small height, are sometimes constructed without a down-stream slab.

Perhaps, said the author, one of the most economical uses of reinforced concrete is for constructing elevated tanks. A reinforced concrete tank can be constructed at a cost of from 40 to 50 per cent. that of a tank formed of riveted steel plates; and they will in general be less expensive than tanks of pressed steel or cast-iron plates. When designing circular reinforced concrete tanks, it is, he thinks, advisable to limit the working resistance of the steel to 12,000 lbs. per square inch, since, though the tensile resistance of the concrete is neglected, the elongation of the steel bars must induce elongation in the concrete; and a higher stress in the steel will in all probability cause the concrete to crack. It is also advisable to insert two series of circular rings in the walls of the tank, one near each surface, in place of one series at the centre of the thickness. Some typical examples of concrete tanks were described and illustrated in the paper.

In the construction of reservoirs that are entirely or partly in the ground, Mr. Marsh said the question as to the economy or otherwise resulting from the use of reinforced concrete should receive careful consideration before its employment is decided upon. The method of design will also require much attention. In many cases it is not economical to use reinforced concrete for the walls or floor; but it is almost universally an economical material for roof construction. If a considerable portion of the depth is below ground, the form of retaining wall construction, with a bottom slab at the back tied to the front slab by ribs, is not an economical form, as the excavations have to be considerably enlarged to accommodate the bottom slab. A wall designed as a cantilever, supported from the floor of the reservoir, will reduce the excavation; but great care is necessary to provide ample support at the bottom to prevent failure between the base of the wall and the floor when the reservoir is empty. If the reservoir is covered, and the covering can be constructed before excessive loading is brought upon the walls, the roof beams and similar beams formed in the floor can be constructed to support beams along the top and bottom of the wall, which, in their turn, support the ends of vertical beams between which the walls of the reservoir can be constructed as slabs with horizontal reinforcements. The covering usually adopted for reservoirs is of the beam and slab type, similar to ordinary floors, and supported by columns; but small circular reservoirs may be covered with a flat dome, in a similar manner to that frequently employed for elevated tanks. Open aqueducts built almost entirely above ground-level, and those for carrying water over valleys, may, with economy, be constructed of reinforced concrete; but for those constructed mainly below the ground-level, this material will not be so economical, for the same reason as in the case of reservoirs.

Pipes under small heads—say, up to about 40 feet—may be constructed of reinforced concrete without any special impervious material being embedded in the thickness. For heads over about 40 feet, some special impervious layer will be necessary. The well-known Bonna pipe is a good example of this type of construction. The impervious layer is formed by a thin sheet-steel tube, with longitudinal welds formed by the oxy-acytelene or electric process. This tube is embedded in the thickness of the concrete, with the reinforcement outside for smaller heads, and inside and outside for greater heads. Reinforced concrete pipes when of convenient diameter are moulded vertically. Photographs were shown of the moulding operations for the 42-inch Bonna pipes for the Leeds Water-Works, for the conveyance of water from one of the reservoirs to the Westwood filters, under a head of about 50 feet. Pipes up to about 4 feet diameter are moulded in advance, and the joints formed with a reinforced concrete collar. For low pressures, the collars are simply run with cement mortar; but for high pressures the joint is made with a steel corrugated ring, into which are driven lead pipes filled with gasket. The collar is then threaded over the joint and run in the usual manner. Large pipes must be formed *in situ;* and in this case great care must be taken to form a good connection when recommencing the work after a stoppage. In designing pipes, the stress in the steel should be limited to 12,000 lbs. per square inch, and it is advisable to form the reinforcement with outer and inner spirals when the pipes are of large diameter. The thickness of concrete for pipes may be approximately 1 inch per foot of diameter, with a minimum of $1\frac{1}{2}$ inches.

DISCUSSION.

The President (Professor Henry Adams) said that some information as to the amount of reinforcement in various cases would be useful; and among the important points for consideration were the use of materials to increase the imperviousness of concrete; and the question of the strength when such materials were used.

Mr. W. B. Butler, speaking with regard to waterproofing, asked what proportion of hydrated lime could be used for adding imperviousness without injuriously affecting the strength.

Mr. Marsh replied 10 per cent.—a figure which was arrived at by experiments carried out in America.

Mr. Butler said there were a great many preparations on the market for rendering concrete waterproof; but it was doubtful if they were of much use. He was very much of the opinion that if the concrete were properly mixed and graded no addition was necessary.

Mr. H. J. Tingle asked as to the method for preventing cracks in aqueducts, due to temperature variations on the outside.

Mr. M. Noel Ridley felt great timidity in relying solely on the concrete, without some admixture to make it waterproof.

Mr. S. Bylander asked whether experience had shown any difference in effect when the reinforcement was placed wide apart, compared with having the reinforcement close together.

Mr. W. J. Leverton suggested that the mixture of hydrated lime for waterproofing purposes would considerably increase the length of time required for setting, and would also involve the centering being left on longer.

Mr. H. J. Harding expressed the opinion that the waterproof qualities of concrete depended to a great extent on the amount of water used in mixing. Too much water tended to make the concrete porous.

Mr. Marsh, in reply, said he saw no reason why hydrated lime or other substance should not be added to ensure waterproofness, though an absolutely well mixed and proportioned concrete should be sufficiently water-tight for ordinary purposes. It would hardly be economical to use reinforced concrete for wells, because the walls were entirely in compression. As to the distance between the reinforcing rods, he favoured putting them close together and keeping them small, rather than having big rods far apart. The effect of hydrated lime on the setting-time was to slightly increase it, but not sufficiently to make any great difference.

Trade Conditions after the War.

On the invitation of the Council for the Organization of British Engineering Industry, a meeting of engineers took place in Manchester some days ago, to hear an address by Mr. T. C. Elder on the "Engineering Industry and Public Policy." In this, the need was urged of a heroic national effort of re-organization, or else, "even with victory in the field, we should pass on to social and industrial disaster." The output capacity of British engineering had, said the author, been increased during the war by an amount estimated at from 30 to 50 per cent. Extensions had also taken place in Germany and Austria, as well as in various other countries. The character of the equipment of engineering factories, too, had been considerably altered. It was essential to our future prosperity that Britain should be pre-eminent in the engineering and chemical industries. As to the Government, all indications suggested that we should reach peace totally unprepared, and "enter upon another desperate scramble to make up for lost time with wrong men and wrong measures, foolish amateur experiments, and much money thrown away." As to the engineering industry, this, he declared, would fall far short of what was possible if it did not organize a general Association powerful enough to exert collective influence in all foreign markets, to offer authoritative counsel to the Government, to stimulate scientific research, and to bring it into closer communication with industrial progress. There was some discussion; and the feeling of the meeting was reflected by the unanimous passing of a resolution, on the proposition of Mr. Fred. J. West (President of the Manchester District Engineering Trades Employers' Association), who pleaded for the maintenance of a happy relationship between employers and workmen, and also urged that firms should specialize more than they had done in the past. The resolution was to the effect that, in view of the greatly enhanced capacity of the British engineering industry, now engaged on munition work, and of the severe competition to be expected after the war, the meeting was of opinion that the organization of the industry from within should immediately be undertaken. As noted elsewhere, Committees have been nominated by the Board of Trade to consider the position of certain industries (among them engineering) after the war.

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Fuel Economy and the Utilization of Coal.—In response to requests that were addressed to him from different quarters, Professor William A. Bone, D.Sc., Ph.D., F.R.S., of the Imperial College of Science and Technology, has thoroughly revised the series of three lectures on "Fuel Economy and the Utilization of Coal" lately delivered by him at the Royal Institution. They have been printed together in pamphlet form, and are now on sale at the "Journal" Office.

COKE FUEL FOR STEAM-BOILERS.

By E. W. L. Nicol,

Engineer and Fuel Expert to the London Coke Committee.

[A Paper read before the London and Southern District Junior Gas Association, March 24.]

In presenting the following paper, it is proposed to consider the influence of fuel characteristics on the thermal efficiency of steam generating plant, and their relation to the commercial value of steam-raising fuels. A study of the relative commercial values of industrial solid fuels in general use in the London district will show that this subject is one of considerable immediate interest to the gas industry generally, and particularly to the branch represented by this section of the Junior Gas Association.

It will be seen that the price which in normal circumstances the steam user has to pay for coal is not, except in certain cases, based upon the gross calorific value, but upon the net evaporative value realized when it is fired under the conditions usually obtaining in steam-boilers. In these conditions are included those imposed by local authorities as to the emission of smoke. The advent of the mechanical coking stoker, and the somewhat short-sighted policy of its general adoption in electricity supply and other power works, has created a demand for coal slack which threatens to exceed the available supplies, with the inevitable result that the price, which has about doubled during the past ten or fifteen years, is now in excess of that paid for better quality coal by steam users who are not restricted in their range of choice by stoking machinery which necessitates the use of a more or less uniform class of bituminous coal slack.

Incidentally, the demand thus created has resulted in a desire to purchase such fuel on a sliding-scale principle, based upon the gross calorific value with certain limitations as to moisture and ash content; an equivalent weight of coal usually being allowed for according to the percentage variation from the agreed standard values. So far as the writer is aware, the use of this basis of sale, which provides merely a useful means of comparison of gross calorific values, has been adopted chiefly by large users of coal slack; but it has recently been suggested that the same principle should be applied in the sale and purchase of all solid steam-raising fuels. Applied equally to all such fuels without regard to characteristics which determine the degree of efficiency attainable in using them, this principle would be, in the writer's opinion, quite unacceptable—more especially from the fuel manufacturers' or sellers' point of view.

Equitable Basis of Sale.

An equitable basis of sale and purchase would have regard to the relative proportion of fixed carbon and volatile hydrocarbons contained in the fuel. Without due appreciation of these factors, adequate protection to the buyer or the seller cannot be ensured. The difficulty experienced in burning coal under steam-boilers smokelessly and efficiently is in direct proportion to its volatile content; and it is chiefly this factor which automatically forms the present basis of appraisement. While many steam users prefer to employ coal slack because of the greater heat value obtainable per unit of cost, others prefer large steam or the more expensive anthracitic Welsh coals. But the practical results realized in cost of evaporation with the various grades available at normal prices show only a small margin in favour of any particular class after due allowance has been made for maintenance of mechanical stokers or other charges incidental to their use. The smokeless characteristic of Welsh coal, due to the relatively high proportion of fixed carbon, renders its use in certain localities desirable; but it would be wrong to assume that for this reason alone Welsh coal commands the higher market value, which is relatively out of all proportion to its superior calorific value. Many shrewd buyers use Welsh coal, although so-called bituminous coal of about equal calorific value may be obtained at 20 per cent. less cost. Therefore, to reconcile the South Wales colliery owner to the price accepted by his *confrères* of the Midlands on the basis suggested would be a matter of some delicacy; but, on the other hand, the gas companies may reasonably expect to realize for coke having at least an equal proportion of fixed carbon and a relatively higher efficiency, a price which bears a closer relation to that obtained for Welsh coal. Compared with Welsh coal, the only additional charge incidental to the use of coke which can reasonably be debited against the latter is the cost of blowing, when this is necessary to maintain an equivalent rate of combustion.

Need for Inexpensive Appliances.

In marketing their gaseous combustible products, gas and other fuel companies have good reason to appreciate the advent and development of inexpensive appliances for burning gas efficiently at high temperatures. The relatively high cost of the forced-draught apparatus necessary to burn coke at a high temperature is largely responsible for the comparatively limited market and poor prices realized in the past for their solid fuels; and continued reliance upon private enterprise in developing efficient and inexpensive apparatus for this purpose will not, in the writer's opinion, tend towards the removal of this obstacle.

The immense capital sunk in steam-generating plant, presumably designed and rated on a coal-fuel basis, renders it imperative that any coke-burning attachment must conform to existing conditions, and to readily commend itself to a steam user it must be inexpensive and capable of maintaining or increasing the steaming capacity of his boilers; while it must, if necessary, be suitable for attachment to a boiler-furnace without any, or any serious, interruption to its working. That these conditions can generally be ensured has already been largely shown. But a great deal still remains to be accomplished in this and other directions; and it is to be hoped that sustained effort and financial support will be organized in experimental work in due proportion to the benefits that would accrue. A modest yearly subscription of (say) 1s. per 100 tons carbonized by the gas and coke-oven companies interested would form the nucleus of a fund to provide the necessary means and incentive to inventors in this direction. Without effort and incentive of this description the use of surplus oven and gas coke may continue to be more or less limited to low-temperature apparatus.

State Control.

The developments in State control of fuel supplies and combustion which we are led to anticipate, if exercised on advisory lines with a view to securing national economy in fuel in the widest sense, the writer thinks would be to many steam users a welcome innovation. Such an innovation can only re-act to the benefit of industry in general and the gas industry in particular, by extending the use of the most economical of all fuels from a national standpoint—namely, gas and coke—for power and other industrial purposes. Acting on the dictum "every man to his trade," it would be well for the gas industry to be prepared, in its capacity of the leading fuel authority, with a solution for every fuel problem likely to arise.

A Necessary Preliminary Step.

So far, no very definite indication has been made of the lines upon which control would be exercised; but if one may be permitted to make a suggestion, a useful preliminary step in this direction would be the registration of the effective grate areas of all steam-generating plant, together with the maximum and average hourly rates of fuel combustion. Armed with this information, the responsible authority, vested with the necessary power, would be enabled to act with some degree of precision in so allocating supplies of gaseous and solid fuels that a state of efficient and practically smokeless combustion—at least, so far as steam plant is concerned—would eventually be brought about with a minimum of expenditure on new plant.

The Smoke Problem.

Of all fuel problems, that generally known as the smoke problem is perhaps the most acute. Few steam users have good grounds for complaint of neglect in this connection. Efforts of local governing authorities in this direction have in the past often degenerated into mere chimney watching. The credit side of their account with the nation is no doubt substantial; but who can appraise the national loss and the loss to industry incidental to their activities and arbitrary regulations? A smokeless coal-fired boiler chimney does not necessarily imply efficient combustion. In the writer's experience, such conditions more often involve both reduced efficiency of combustion and, what is probably of equal importance, reduced capacity, chiefly due to the admission of large quantities of excess air to the boiler-furnace or beyond it.

The rigid imposition of the penalties involved in the breach of these regulations is, in many districts, often rendered impracticable by the failure of the fining authority, collectively or individually, to comply with their own regulations. The spectacle of a steam-using department of a municipal body being summoned for smoke emission by a local suburban authority is an instance in point. But the most serious aspect of the problem is the case of the factory, the output of which is limited to the steaming capacity of its boilers under the onerous conditions imposed, and the unavoidable waste of fuel involved in a conscientious endeavour to comply with the regulations.

The lack of competent advisory control is shown in the following example of the operation of these regulations, which is typical of others within the writer's knowledge and may be described to illustrate this point. The weekly bituminous coal consumption of a certain Lancashire type boiler having a well-watched chimney was said to be 27½ tons. During a 22 months' "trial" of coke fuel of considerably lower calorific value, but fired on rational lines, the weekly deliveries have averaged under 23 tons, at 15 to 20 per cent. less cost per ton. The necessary forced-draught apparatus, supplied by the London Coke Committee, and fitted to the boiler on a free trial basis by the gas company, has been purchased outright for £12 12s. by the user, who has expressed himself as being "well satisfied." In this case, at least, the user does not appear to have been misled by interested advice. The present price of this apparatus—£6 6s. per furnace equipment—is a "war" one, and should not be regarded as final.

The true significance of this picture will be appreciated by gas engineers and others who have experienced sudden demands for coke during periods of scarcity of steam coal and an equally sudden falling off of such demands with a return to normal conditions. Introduced on proper lines, with methods and apparatus which ensure the best results being obtained, coke fuel has, in the writer's experience, only to be maintained at a price which shows a reasonable financial advantage to the user in order to secure favour. Moreover, a coke user provided with the apparatus indicated—which, unlike a chimney shaft, has a considerable margin of elasticity in capacity—is less critical in the matter of small and unavoidable variations in quality. Also, the simultaneous introduction of forced draught, which carries with it many practical and economic advantages when compared with natural chimney draught, always tells in favour of coke. Equipped with this apparatus, however, a user has a wide range of fuels from which to choose; and instead of being confined to competition with smokeless coals, coke will, in these circumstances, be made to compete with cheaper and lower class coals. For this reason, therefore, adequate protection should be secured for all coke-burning apparatus, which, unlike gas appliances, is equally suitable for use with competing fuels; and the question of sale outright to the users should have serious consideration.

MECHANICAL STOKING.

The mechanical stoking of gas coke offers considerably more difficulty than is usually met with in stoking bituminous coal mechanically. But important progress has been made in this direction by a few of the leading makers who have specialized in this line—particularly for externally-fired or water-tube boilers of large capacity. Adapted for internally-fired boilers there are the various types of sprinkler stokers. These, and the larger-capacity travelling-grate type of stoker referred to above, are now available where the quantity of fuel consumed necessitates both mechanical stoking and continuous cleaning. These appliances emphasize the disadvantages of the ordinary spasmodic hand firing system with the necessary periodical interruptions for the laborious removal of accumulated refuse. Comparatively small steam plants, which do not warrant the installation of mechanical stokers from the labour-saving point of view, offer a wide field for some form of coke-burning fire-grate capable of being mechanically cleaned. The CO_2 records taken from coke-fired hand-fed boilers (to which the tabulated results also refer) will serve to illustrate this point. These clearly show that, with the balanced-draught system in use, the only serious interruption to an otherwise continuous state of high efficiency, rarely approached with coal-fired boilers under the best conditions of mechanical stoking, are the burning-down and clinkering periods.

SOFT COKE.

The introduction of "semi" or soft coke, suggested in certain quarters, with a view to effecting fuel "economy" might appeal to those operating gas-works in purely residential districts, if such communities do exist. In industrial districts, many processes, and even certain industries as a whole, are largely dependent upon the well-established characteristics of gas coke; and, in the writer's opinion, to radically and generally modify these in the manner suggested would bring serious hardship to many users having apparatus specially designed for the use of coke, and for which no other fuel would be quite as cheap or suitable. The moral obligation of gas authorities to supply these people with suitable non-volatile solid fuel would appear to be second only to their statutory obligation to supply gaseous fuel of a uniform character and quality.

STEAM-BOILER DESIGN.

In the general design of ordinary types of steam-boilers it is difficult to trace any direct influence of fuel characteristics, except, perhaps, in the external setting or baffling. Chief consideration appears to have been given to safety, convection currents, cost, and convenience of construction. That there is little or no difference in the design of gas-works coke-fired boilers and boilers presumably designed to burn coal, would appear to bear out this contention. So far as the boiler makers are concerned, it is the merest accident that the latter are more efficient when fired on coke. In steam generating plant designed to burn coke, the primary considerations, in addition to the above, would be ample grate area and a preponderance of heating surface exposed to the direct radiant and reflected heat of the fire. Except in the matter of unit capacity, progress in this direction, compared with other branches of mechanical engineering, has been remarkably slow. Types installed fifty years ago, and still in use, differ only in matters of detail from those now being made and installed.

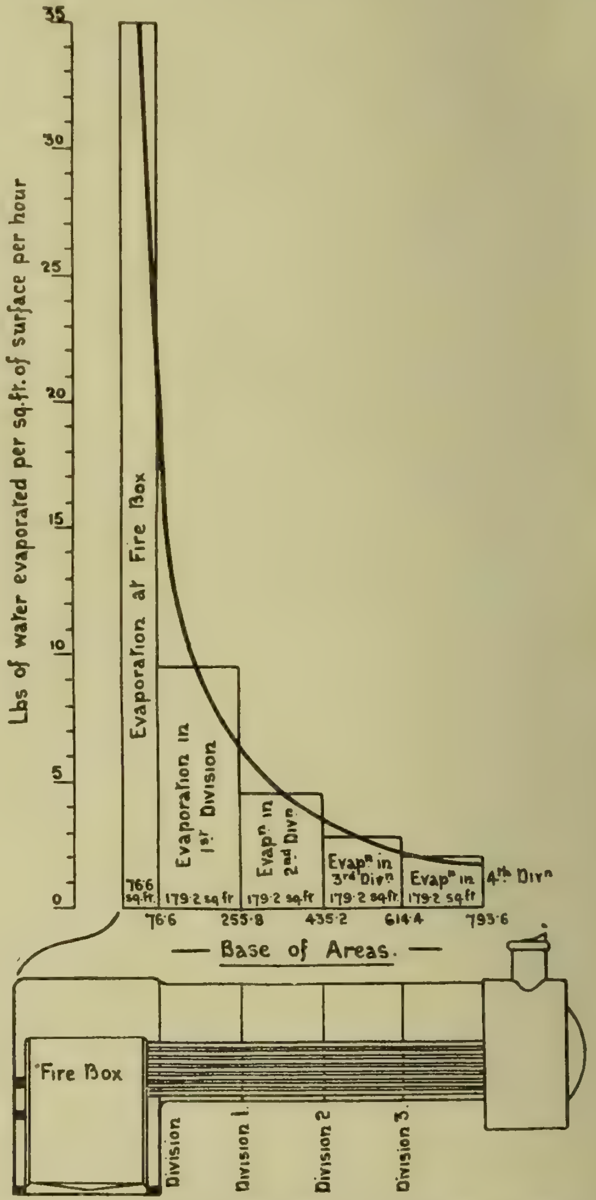
MARINE AND LOCOMOTIVE BOILERS.

Without due reference to the application of coke fuel to marine and locomotive boilers, this paper would have less claim to be complete. On tug-boats and other river craft, coke has been successfully substituted for navigation coal of the finest quality, with and without forced draught; and applied to dredgers, sludge, and pleasure boats, there would appear to be great possibilities in this direction alone. As to steam-waggons, the Heavy Motor Car Act of 1903, and subsequent regulations limiting tare weights to 5 tons, including motive power, have done much to unnecessarily increase the fuel cost of running these vehicles. In order to comply with the regulations, the fire-box and grate area of the boilers, among other things, had to be reduced in order to cut down weight, with the result that the hourly rates of combustion of fuel necessary to realize the rated capacity of the waggon are too high to be economical, and often exceed 50 lbs. per square foot of grate area. The present tendency is, however, to increase grate areas and fire-box heating surfaces.

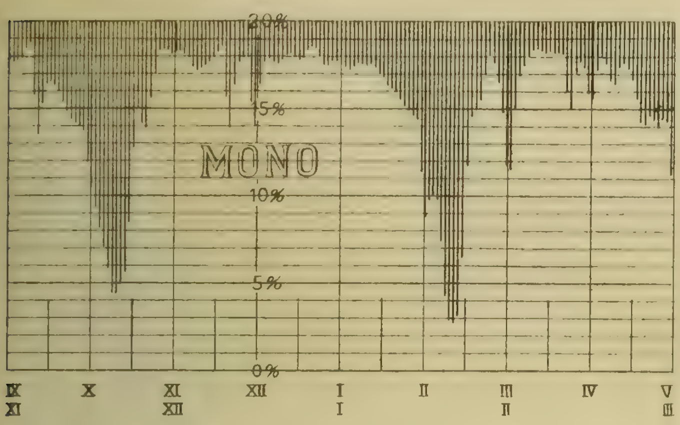
In selecting vehicles for use with coke fuel, gas companies, who are large potential users of this means of transport, would do well to encourage this tendency; and in the interests of national economy in fuel, it is to be hoped that the new regulations now being framed will take due cognizance of these factors. For railway passenger locomotives, the reinstatement of coke fuel to its former position in favour on some of the London lines would now perhaps involve what might be considered a too drastic overhauling of their running schedules; but it is gratifying to note that here also there is a tendency to increase the proportion of grate area to total heating surface. On American railways, where coke breeze, mechanically stoked, has been tried with some success, recent development in this respect, which has the greatest influence on fuel consumption as well as steaming capacity, is shown in the following table:

Ratio of Total Heating Surface to Grate Area.			*Ratio of Fire Box-Heating Surface to Total Heating Surface.*	
1903.	1913.		1903.	1913.
66·4 ..	56·1	..	5·9 ..	7·3
Percentage decrease, 15·5			Percentage increase, 23·7	

The changes in these important factors are in the right direction, and may be commended to the notice of British designers of road locomotive and other steam-boilers, in view of the possible trend of coming events in the matter of fuel control. From the diagram, it will be seen that, to produce a given amount of evaporation, less fuel will have to be burned per square foot of grate area, resulting in a higher fuel efficiency and a wider margin of fuel capacity when it becomes necessary to force the boiler; while a distinct gain in thermal efficiency is realized by the increase in the ratio of fire-box area to total heating surface. Reliable tests have shown that 1 square foot of fire-box heating surface will evaporate about five times as much water per hour as will 1 square foot of tube surface. The diagram shows graphically the relative efficiency of fire-box and other heating surfaces, and, although based upon conditions obtaining on a coal-fired locomotive type boiler, it is applicable to any other type. Fired with coke fuel, in which case refractory arches are found to be unnecessary, combustion and evaporation would be still further located to the fire-box area.



Plotted Results of Five Experiments on the Northern Railway of France, on a Locomotive Boiler divided into Five Watertight Compartments, showing the Efficient Evaporative Surfaces.



Fuel Test.

Conducted by .... Consulting Engineers.

February, 1916.

FUEL TESTED. System of Draught. System of Stoking.	Bituminous Coal. Natural Draught. Hand Fired.	Gas Coke, "L. Coke C." Blowers. Hand Fired.	Gas Coke and Coke Breeze. "L. Coke C." Blowers. Hand Fired.
Cost per ton delivered . .	25s.	25s.	Breeze at 10s. Average at 17s. 6d.
Duration of trial, hours . .	6·50	7·25	7·66
Type of boilers (2) . . .	Cornish	Cornish	Cornish
Total grate area, square ft.	58	58	58
Amount of fuel used, lb. .	6720	7500	4200 coke 4200 breeze
Fuel burnt, per square foot grate area per hour, lb. .	Max. 16·1	Limited to 16·1	Limited to 17·1
Water evaporated, lb. actual	45,950	65,600	59,200
Water evaporated per boiler per hour, lbs.	3530	4520	3860
Water evaporated per lb. of fuel	6·83	8·74	7·04
Water from and at 212° per lb. of fuel	7·74	9·80	7·99
Cost per 1000 galls. evap'ed	14s. 5d.	11s. 8d.	9s. 5d.
Temperature of feed water before economizer . .	110° Fahr.	118° Fahr.	107° Fahr.
after economizer . .	218° ,,	196° ,,	193° ,,
	108° increase	78° increase	86° increase
Per cent. CO_2	Not taken	16·0 average	16·25 average
Steam pressure	45 lb.	58 lb.	52 lbs.
Net working efficiency of plant, deducting 3 per cent. of steam used under bars for blowing . . .	Not ascertained, probably about 70-72 p.c.	85 per cent. approx.	80·9 per cent. approx.
Financial saving effected by adopting coke fuel and forced draught . . .	—	19 per cent.	34·6 per cent.

Mr. Nicol exhibited at the meeting two scale models of the forced-draught apparatus referred to in the address. These were exact miniature replicas of those which are now being extensively installed on boiler-furnaces, with a view to substituting coke for coal, and which are applicable to furnaces of from 2 ft. 3 in. up to 4 ft. diameter. As to the coke-burning capacity of the apparatus, Mr. Nicol explained that this was limited by the tendency of the fuel to drift upon the grate; but in his experience the maximum rate necessary did not often exceed 25 lbs. per grate foot-hour. At 22·5 lbs., the steam consumption had been independently ascertained to be 3 per cent. of that generated, a figure which would bear favourable comparison with the steam consumption of engine-driven fans.

DISCUSSION.

The President (Mr. S. B. Chandler, of the South Suburban Gas Company), in inviting discussion, said they were much indebted to Mr. Nicol for having come to address them on so important a subject.

Mr. J. G. Clark (Gas Light and Coke Company) remarked that one thing which had struck him while listening to the address was the great value of coke from the point of view of smoke prevention. With regard to coal, no doubt some of those present had seen recently a report in the "Lancet," in which there were summarized data collected from different parts of the country in reference to atmospheric pollution; and this indicated plainly that coal, unless it was very carefully used, which was not always the case, was likely to give off products which were unpleasant, not only from the point of view of dirt, but from that of rendering the air impure for respiratory purposes. Mr. Nicol had spoken of the importance of the heat basis as a basis for the valuation of coke. This was unquestionably a great thing. Some years ago, the late Professor Vivian B. Lewes, in a lecture entitled "Candles and Calories," sounded the death-knell of the candle, by emphasizing the importance of the calorific basis of measuring. It was just as important in the case of fuel they bought by the ton. Looking at the table, he noticed that the heat value of the coke used was not given. If this were added, it might be useful for reference in judging the other figures. A matter which always struck him in connection with the combustion of fuel was this: The heat from a pound of fuel was developed in at least two ways—part as flame, and part as radiation. This was described in the address. There was no question that the proportion of the heat given off as radiation and of heat as actual flame affected the ultimate efficiency of the fuel from a practical point of view. Coke, he thought he was safe in saying, gave off a larger proportion of radiant heat than ordinary bituminous or any other kind of coal. Mr. Nicol had told them, too, that as a matter of accident the present type of boiler happened to be very well suited for the use of coke. Might not this to a great extent be due to the fact that a large proportion of the heat of the coke was given off in the form of radiation? A more efficient surface for the absorption of radiation than the tubes of a Lancashire or Cornish boiler coated with oxide of iron, one could hardly have. To this extent, coke must be favoured, because the larger proportion of the heat was given off as radiation. On looking at the table, he was impressed by the high figures of CO_2—16 and 16·25 per cent.—when coke was used. These were, of course, exceedingly good—corresponding roughly to an excess of only about 25 per cent. of air; and to thoroughly consume fuel with such a small excess of air, to some extent accounted for the increased efficiency. Mr. Nicol had stated, in describing the locomotive boiler shown in the diagram, that the same argument would apply in the case of a Lancashire or Cornish boiler; but in the locomotive fire-tube, one could not get very much propagation of flame, whereas one might get a lot along a boiler of the other type, as there was much more space. Therefore there might not be such a sharp drop in the curve as they saw was the case with the locomotive. It would tend to level itself, perhaps, by being not so high at the beginning, and not so low at the end.

Mr. F. C. Briggs (Gas Light and Coke Company) said the author had mentioned the question of solid fuel being sold on the calorific basis. Was this being practised at the present time? Then there was another point which was rather away from the subject, but which interested them as gas men very much. Had the author any experience of the use of pitch, fired with coke under the boilers? The question of pitch had, as they were all aware, become a serious matter; and it had been suggested that they should carbonize it with coal in the retorts. Certain experiments that had been carried out had led him to form the opinion that this was probably not the way out of the difficulty, and that if they were to get rid of the pitch a more reasonable method would be to burn it under the boilers with coke. There were several difficulties to overcome—particularly that of smoke. It had to be mixed very intimately with the coke, and very carefully fired. Could Mr. Nicol give them any information as to the use of pitch with coke in this way?

The President said he was gratified to see present the Chief Engineer of the South Metropolitan Gas Company, and they would like to hear some remarks from him.

Mr. G. M. Gill said he had not come to the meeting with any idea of joining in the discussion; but when he saw that Mr. Nicol was down to give an address, he had determined that he would be present to hear it, because Mr. Nicol was one of the few people in this country who really understood this important subject. He had given them a highly interesting address, full of information which they ought to study as closely as possible. The subject of the use of coke under boilers was one of the greatest importance to the gas industry. It was a subject which had not received nearly so much attention as it should have done; and it was quite time that gas undertakings made up their minds to push it, and do all they could to introduce it to the notice of fuel users. He would like to make the suggestion that the example set by the London Coke Committee, in appointing an expert to promote the use of coke in the Metropolitan area, should be followed by provincial undertakings throughout the country. It might very well be done by the Commercial Sections attached to the different Gas Associations. He felt sure that if this were done, they would really begin to make progress. Coke as a boiler fuel had always been very much underrated by power users. Why this was, he really did not know; but he thought that what had had a lot to do with it was that coke required more draught than coal. The secret of doing well with coke in a district was to induce as many people as possible to go in for forced draught apparatus such as Mr. Nicol had devised. This was really the secret of the whole thing, if boilers were to work at their maximum capacity fired with coke. Mr. Nicol pointed out that it would not be fair to coke to buy it on a mere calorific power basis. This was very true; and it was shown in the high CO_2 return in the waste gases, which one could get with coke. With coke, being a purely carbon fuel, there was not the same necessity to use a large excess of air. In fact, it was possible to tremendously cut down the amount of air for combustion. As to using pitch under boilers, he was afraid this would not be possible, because pitch fused at such a low temperature. What he was told happened in actual experiment was that directly it was put in the furnace, it ran through between the fire-bars. With reference to coke for boiler purposes, Mr. Nicol had not compared broken coke with large coke; but he (Mr. Gill) believed it was a matter of great importance that broken coke should be supplied. One could not get the same capacity out of the boiler fired with large coke. Then came in the question of breaking coke and the consequent making of breeze. He would like to hear the author's opinion as to the advisability of supplying coke and breeze mixed—that was to say, taking large coke at the works, and breaking it up, and then supplying the whole of the material, both coke and breeze, which resulted from the large coke put through the crusher. The comparatively small percentage of breeze that would be thus included would not, it seemed to him, prove any great detriment; and the fuel could, of course, be offered at a correspondingly lower price.

Mr. J. Hewett (South Metropolitan Gas Company) asked Mr. Nicol if he had had any experience in regard to the action of the gases from a coke-fired boiler on the internal parts of the tubes. He could imagine that in a locomotive boiler fired with coal, for instance, where considerable smoke was produced, this smoke would operate more or less as an insulating material, protecting the inside of the tubes, and preventing them from being acted upon to such an extent as they would be by the gases from the coke alone. The more local heating which would result from the combustion of coke would probably have a definite action on the tubes; and he (Mr. Hewett) would be glad to be told that this would be rather in favour of coke than otherwise.

Mr. D. C. Cross (Lea Bridge) thought it might interest the members to hear one or two figures which he had just taken out. Since Christmas, his Company had adopted the idea of transporting their coke in coke-fired steam-waggons. The waggon they used was of the 3 ton "Sentinel" type, and was delivering from three to four loads a day. The fuel consumption appeared to be exceedingly small. The miles per hundredweight of coke consumed worked out for the three months at 5·8 including lighting up and standing losses; and the average quantity of coke carried was 50 cwt. That was to say, for 1 cwt. of coke burned, they could carry 50 cwt. 5·8 miles. This seemed extremely low, and very encouraging. Taking the coke at 25s. per ton, the cost was 2·6d. per mile, or 1d. per mile per ton carried. After the war, when makers could devote a little more time to pushing waggons of this kind, he thought there would be a great outlet for coke.

Mr. Nicol, in replying on the discussion, remarked that Mr. Clark had raised some points of peculiar interest. The valuation on its calorific basis of coke—and, for the matter of that, any other solid fuel—was, in his own opinion, sure sooner or later to come about. It was established now in the gas industry in the case of gaseous fuel; and it would be only one more step towards standardization generally to sell coke on a heat value basis. But while coal was very often sold and purchased on this basis, it would not, he thought, be an equitable basis in the case of gas coke, simply because, as Mr. Clark had pointed out, it was possible to burn coke under ordinary hand-fired conditions with a 25 per cent. or smaller excess of air, whereas in burning coal under the best conditions of mechanical stoking 50 per cent. was necessary, and under ordinary natural draught 100 per cent., or even 200 per cent., excess was quite usual. The radiant efficiency of coke fuel was, of course, much higher than that of coal, for the reason that it was a purely carbonaceous fuel, and burned freely without smoke or luminous flame. In statements of relative boiler efficiency, the characteristics of fuel were generally neglected; the efficiency being stated merely on the gross calorific value. Mr. Clark was quite right in saying that combustion would be extended to a greater degree along the fire-tubes of a Lancashire-type boiler than in one of locomotive type. Where one was 1 or 1½ inches diameter, the other might be 2 ft. 6 in. or 3 feet. As to Mr. Briggs's question, the calorific basis for coke might very well be reduced to the ash basis, on similar lines to the water basis for tar and oils. The burning of pitch smokelessly under boilers was a matter to which he had given a considerable amount of attention; and, in his opinion, to break it and fire it in the furnace along with other solid and less volatile fuel would be quite hopeless from this point of view. It would no doubt lead to all sorts of troubles in addition to this, by running through the fire-bars and getting into the ash-pit. He had got out a tentative scheme for gasifying pitch and burning the gas in the boiler furnaces, and burning the pitch coke also under the boilers, as it accumulated. In reply to Mr. Gill, the whole subject of boilers and boiler firing should be to gas undertakings, in their capacity as steam users, one of very considerable interest. Compared with other industries, including that of electricity supply, gas undertakings were probably among the largest steam users. In the case of two companies that were represented on the London Coke Committee, there were no less than 425 boilers in use. These, without exception, he believed, were coke-fired, and for the most part under forced draught conditions. The boilers were insured with the usual boiler insurance companies; and so far as he had been able to ascertain, no comment whatever had ever been made by the insurance companies' inspectors with reference to the action of gases from the coke fuel affecting the boiler-plates. There were cases of boilers of the most sensitive type in this respect—the Babcock water-tube boiler—having run continuously with coke fuel for fifteen years without the renewal of a single tube. Mr. Gill's suggestion that Coke Committees should be set up in the Provinces appealed to him as being a thing that should go without saying, because the effect on the market generally of an accumulation of provincial coke was very noticeable. It seemed to him, however, that there should be no good reason why testing plant should be duplicated and laid down, with a view to collecting data regarding coke fuel. If the plant were located at one centre, it would be the better plan; and the information collected could be distributed to those interested. As to broken coke, in some instances, where the rate of combustion required was high, it became necessary to employ coke so graded as to ensure the maximum rate attainable. The breeze made by reducing hard coke to this grade might very well be delivered with the coke; but as this had been a source of complaint in the past, it would be unfortunate to establish any method which would give careless loaders a loophole. It did occasionally happen that breeze was sent out now, without any such loophole being allowed, with very serious consequences in certain cases. The carbonaceous scale deposited on the heating surfaces of locomotive and other coal-fired boiler tubes not only acted as a preservative of the tubes, but incidentally was a very effective insulator—he believed about five times as effective as asbestos. It took from three days to a week of coke firing with a boiler which had been previously coal fired, to get rid of this scale. There was no detrimental effect with coke, so far as he had been able to ascertain, due to local heating. After all, it was only a question of intensity; and if a steam user could not obtain sufficient steam with an inferior coal, he had no hesitation in using coal which would develop a much higher heat. The fuel cost of running steam-waggons on expensive Welsh coal was a point which had not been lost sight of by the London Coke Committee. The remarkably low figures quoted by Mr. Cross showed that to start with a steam-waggon such as the "Sentinel" designed to burn coke was a better proposition than taking a waggon that had been badly designed to burn coal, and subsequently firing it by coke. The "Sentinel" was a waggon that the makers said would do better on coke than on any other fuel.

Mr. Hewett: Is it the rule to state the calorific value of coke on the dried or the undried basis?

Mr. Nicol replied that in these tests allowance had been made for the moisture. The calculation was based on the calorific value of the coke, including moisture and ash.

The President said the London Coke Committee were doing excellent service, and were to be congratulated upon having such an exponent as Mr. Nicol. Everyone must have noticed the large number of steam-lorries that were now on the roads.

A hearty vote of thanks was passed to Mr. Nicol for his address, on the proposition of Mr. Clark, who said that as time went on the gas industry would be under a growing debt of gratitude to Mr. Nicol for popularizing the use of coke for industrial work.

Mr. Briggs, in seconding, urged that more attention should be paid to the economical raising of steam on gas-works.

Mr. Nicol returned thanks. He said it had been a great pleasure to read the paper. While his remarks applied to conditions prevailing in the London district, the views expressed were given entirely on his own responsibility.

Evening Star Lodge.

The installation meeting of the Evening Star Lodge was held at the Freemasons' Hall, Great Queen Street, E.C., last Wednesday, when the retiring W.M. (W.Bro. Arthur E. Croager, P.P.S.G.D., Kent) installed his successor, W.Bro. J. Fred. Wicks. Subsequently, the following officers were invested:

Senior Warden	Bro. A. P. Main.
Junior Warden	W.Bro. Fred J. West.
Treasurer	,, A. E. Broadberry, L.R.
Secretary	,, W. T. Dunn, L R.
Senior Deacon	,, H. W. Packham. P.P. J. G. D. Surrey.
Junior Deacon	Bro. Corbett W. Woodall.
Director of Ceremonies	W.Bro. E. G. Smithard.
Organist	Bro. J. F. Simmance.
Inner Guard	,, H. G. Warren.
Stewards	,, Alfred C. Beal. ,, Charles Clare. W.Bro. R. W. Foster, L.R.

W.Bro. Wicks was initiated into Freemasonry in the Evening Star Lodge on Oct. 24, 1900. He was a founder of the Beaconsfield Lodge, No. 2849, in 1901, and is a member of the Evening Star Chapter.

Gas Supply in Norway.—According to a "Chemiker Zeitung" report, the sixteen gas-works in Norway, of which ten are under private and six under municipal ownership, in the year 1914-15 produced 1493 million cubic feet of gas, as compared with 1300 million cubic feet the preceding year. The number of consumers rose in the same period from 61,704 to 68,076. The quantity of coal used in all the works was about 133,000 tons, against 120,000 tons in the year 1913-14. Owing to the export of tar having been prohibited since the outbreak of war, the gas-works, which formerly disposed of their tar to German distillers and colour works, have had to use it as fuel in place of coke.

Society of Engineers.—At a meeting to be held next Monday, at 5.30, in Caxton Hall, Mr. J. E. Lister will read a paper entitled "Modern Coal and Coke Handling Machinery, as Used in the Manufacture of Gas." It is the intention of the author to deal with the production of gas from coal; the cost of handling coal and coke; the introduction and development of mechanical stoking in gas-works; various retort charging and discharging machines; coal unloading, breaking, elevating, and conveying machinery; scraper, bucket, and belt conveyors; coke-handling machinery; conveyors and telpherage plants; vertical retorts; adoption of coke-ovens for the production of town's gas; and coke-oven charging and discharging machinery.

THE POSITION OF SCIENCE.

Professor Armstrong's Views.

The second of his two Royal Institution lectures on "Explosives and Drugs Made from Coal Tar Products," was delivered by Professor H. E. ARMSTRONG, F.R.S., last Thursday afternoon, when information was given regarding many well-known drugs.

In the previous lecture [*ante*, p. 632] attention was devoted to explosives; and on resuming his subject, Professor Armstrong drew attention to the recent speech of the Chairman of the Bradford Dyers' Association, which was dealt with in the "JOURNAL" at the time, in which the close connection was pointed out between explosives and dyestuffs—the materials were the same, and the works which prepared one prepared the other. The lecturer said he did not think it was generally realized how much the Royal Institution, through Faraday, was linked-up with these industries. In his early days, Faraday was a chemist, and did work of extraordinary brilliance. Faraday it was who, when experimenting with oil gas, discovered benzene—one of the chief pillars of organic chemistry, and the foundation stone of the organic chemical industry. Benzene was discovered and defined in that Institution over ninety years ago. The study of the light hydrocarbons of coal tar on the lines laid down by Faraday in his pioneer investigation of the bye-products of the oil-gas industry, was undertaken close by, at the Royal College of Chemistry, in 1846. Benzene and toluene were then separated for the first time. Ten years later, the first artificial dye was discovered and manufactured from benzene in this country, near Harrow. The first time a perfume was made artificially was also in this country, again near Harrow. The connection between chemical constitution and physiological action was first brought into prominence by the inquiry of Crum Brown and Fraser, carried out in Edinburgh, in the late sixties. Abel brought the guncotton industry into stable existence in the early sixties, and the application of guncotton in conjunction with nitro-glycerine to military use was in the main the work of Abel and Dewar.

Why, asked Professor Armstrong, after being pioneers so often, and having done so much, have we allowed ourselves to fall so much behind, and be so dependent upon others? Why is it necessary now to urge that science and industry must be brought into conjunction? These and many other questions must be pondered and answered—and so answered that we can do better in the future. Our failure is traceable to Oxford and Cambridge, and the public schools. We have placed so high a premium on classical studies that most of the ability of the country has been either forced or attracted away from science; and the nation has been kept in ignorance of science by the literary party, almost of set purpose, it would seem. As there has been no regular remunerative outlet for science, few have been led to take it up; and the few who have, finding little opportunity in industry, have sought for recognition elsewhere. No sufficient use is being made of the resources the Royal Society commands. The men of most experience in the country have been allowed to remain unutilized—the services of those who have been taken have too often been misapplied.

Proceeding, he said: The waste which is taking place through faulty organization of effort is colossal. Opportunities of future development are in no way taken into account. It is not that science is unable to help; it is simply not allowed to do so properly, the work being largely in the hands of the inexperienced. It is useless, however, for us to complain of Government apathy, of public ignorance of science, when we, the body scientific, are unable to cope with our own affairs—while we remain unorganized in our own service. My anxiety for the future arises mainly from the apathy I find everywhere; from our inability to look the trouble in the face; especially from our unwillingness to combine forces. Science, it is to be feared, in this country at the present time is losing rather than gaining caste. This is because it is ineffective in its collective aspects, and therefore voiceless in the councils of the nation.

On the day preceding the lecture, it seems, a conference convened by the President and Council of the Royal Society was held; and it was decided by the representatives of the scientific and technical societies present that it was desirable to establish a Conjoint Board of Scientific Societies for the purpose of: (1) Promoting the co-operation of those interested in pure and applied science. (2) Supplying a means by which the scientific opinion of the country may, on matters relating to science, industry, and education, find effective expression. (3) Taking such action as may be necessary to promote the application of science to our industries and to the service of the nation. (4) Discussing scientific questions in which international co-operation seems advisable. A Committee was appointed to draft a scheme.

Yorkshire Junior Gas Association.—Arrangements have (by permission of Mr. Charles Wood, the Engineer and Manager) been made for the members to visit next Saturday the Birkshall works of the Bradford Corporation Gas Department, where a 5 million cubic feet installation of Woodall-Duckham vertical retorts is now in course of erection. The Hon. Secretary (Mr. Edward Garsed) says the Council hope to hold two more meetings this session.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Tar and Pitch Prices.

SIR,—The letter of "N. W." in your issue of the 21st inst. so nearly agrees with prevailing conditions at my works, that I am constrained to state the result of my inquiry to our tar distillers for pitch for carbonization, and let your readers agree how much bluff there is in some of the tar distillers' protestations as to profitable prices, and how much genuine desire to meet and make the most of circumstances.

Some time before receiving the circular letter of Mr. Young, the President of the Institution of Gas Engineers—*re* the "Carbonization of Pitch"—I approached our tar contractors for a price delivered at our works for pitch to experiment with, promising, if successful and price right, to relieve them of a quantity equal to 5 per cent. of my coal carbonized. They pay 21s. per ton at our works for the tar.

At the time of my inquiry, the "JOURNAL" price for pitch at Liverpool and Manchester was 14s. to 15s. per ton; and these are the nearest comparative prices available with my works. I expected something like 17s. to 18s. delivered, which is considerably above the basis suggested in Mr. Young's circular-letter.

The quotation was 20s. per ton net cash at their works, and carriage 3s. 6d. per ton—making a total of 23s. 6d., which is well over the price at which I am putting coal carted and trimmed into my works.

No amount of persuasion or counter-offers will move the firm one jot from their original offer; while they take the opportunity of reading us a homily on the absolute beggary the present contract prices for tar are reducing them to, &c., &c.

Now, I am not out for a one-sided bargain; but if, as the tar distillers say, the immense accumulations of pitch are reducing the value of tar, and gas authorities are willing to pay the current price of pitch, and so relieve the congestion, it hardly sounds logical for the tar distillers to adopt an attitude which practically (as in my case) puts the question entirely out of court. Besides, one has no guarantee that taking the pitch off their hands is going to have any financial advantage on the next contract price of tar.

The circumstances prevailing almost justify one in suspecting that the tar distillers and contractors do not want to ease the market, for fear they will have to pay an enhanced price for tar.

Gradually, gas managers are being forced into a corner in this and other matters; and when normal times come again, Parliament, as a return and reward for their present work of a national character, should surely be asked to sanction collective action on such matters, so as to break-up rings.

T. W.

March 23, 1916.

SIR,—The letter of "N. W." in your last issue, drawing attention to the depressed price of tar, which he thinks has been artificially created by the distillers, is worthy of very serious consideration.

Within the past few weeks this works had to seek the aid of the Ministry of Munitions in disposing of treated tar stocks. General congestion, due to pitch accumulation, was ascribed by the distillers as the reason for inability to forward loading tanks. On receipt of the Institution circular, suggesting the carbonization of pitch as a remedial measure, we wrote the distillers for a price—intimating that the chief object was to relieve their works' congestion and enable distilling to conveniently proceed. We were asked 27s. 8d. per ton for pitch, f.o.r. here. We receive 15s. per ton for treated tar at the same point. The rail-rate is less than 5s. per ton in each case.

Such offers place the possibility of pitch carbonization quite out of court, unless gas undertakings can afford it, and are prepared to sink the financial aspect of the matter entirely. They suggest the thought that tar distillers are not disposed to assist patriotic endeavour designed for the relief of their own stated difficulties. Such a position will not be accepted without protest.

Referring to tar, we have heard of works in this district where it is being stocked and held, rather than sacrificed at to-day's figures. Holding tar in these times will hardly commend itself to general approval; and some of us have not the means to do so, given the wish. There appears to be a crying need for organized action to safeguard the interests of tar producers in their dealings with certain of the tar distillers.

With regard to the price quoted on this works for pitch supplies, we have placed the correspondence, including the Institution's letter advocating pitch carbonization, before the Department of Explosives Supplies, and already feel assured that full investigation will be made, in the interests of light oils production.

We imagined that the tar grievance was more particularly confined to this district where distillers are few, and even the "JOURNAL" prices, mentioned by "N.W.," do not apply. If, however, his letter denotes general dissatisfaction in other districts, we believe that united application would lead to the intervention of the before-mentioned Government Department, and reap its due reward.

J. ALEX. GRAY.

Gas-Works, Teignmouth, March 25, 1916.

Mortgage Bonds.

SIR,—In reply to the two questions of "Enquirer,"

1. Our construction of the letter from the Inland Revenue is that the duty is 6d. only, irrespective of the amount of the bond.
2. Yes; that is how I understand it.

ACCOUNTANT.

March 23, 1916.

Professor Armstrong and Fuel Economy.

SIR,—As one who is largely occupied in the evaluation of fuels, I should like the opportunity of thanking Professor Armstrong for his contribution to the discussion before the London Section of the Society of Chemical Industry, on the 6th inst.

One cannot always agree with Professor Armstrong, but his contributions to discussions frequently contain the kernel of what other and more diffident people are thinking.

The Society of Chemical Industry should certainly take this question of the economy of fuel in hand. It could not be under better auspices; and a small strong Committee of this body will inspire confidence among those whom the subject most directly concerns.

E. W. Smith.

Birmingham, March 21, 1916.

The Economy of Fuel.

Sir,—I have read with interest the paper contributed by Professor H. E. Armstrong to the Society of Chemical Industry and the remarks of Professor W. A. Bone, together with the discussion, as reported in the "Journal" for March 14; and I hope that the result will be a more general and public interest taken in this important and national subject.

Professor Armstrong rightly says that the coal industry in general, and the use of fuel in particular, should be brought under scientific control, with two great objects in view—the saving of the valuable bye-products at present dispersed into the air, and the avoidance of the great loss caused by unnecessary smoke—highly deleterious and wasteful alike from a financial and a hygienic point of view.

I should, however, at present like to make a few remarks upon the "ideal fuel" for domestic grates, in reply to some of the remarks of Mr. W. J. A. Butterfield in the discussion on the question.

English people are agreed that the up-to-date open grate will remain with us, because of its value for ventilation, and on account of its cheerful appearance. We must, therefore, find a suitable fuel for this grate, by which I mean that it must burn with a good flame, without smoke, must contain a low percentage of gas, and ignite easily after having undergone a process to obtain the valuable bye-products.

These conditions we have in semi-coke—the resultant fuel after a low-temperature treatment. Mr. Butterfield objects that low-temperature coke has nearly double the bulk of raw coal, which I admit. But, on the other hand, I contend, and I feel sure Professor Armstrong will agree, that the radiant heat is far greater, and that in consequence, in practice, Mr. Butterfield's objection to it, on account of its bulk, is not so serious, as less is required.

Mr. Butterfield says: "Low-temperature coke appeals to a certain class of well-to-do consumers, who like the pleasant glow of the fire which it affords, and are gratified by the impression that in using it they are displaying their superiority to other people."

On the other hand, I maintain that it is essentially a fuel for those who have to consider the question of cost and money value. As regards its value from the hygienic point of view, if Mr. Butterfield will apply to the Secretary of the Coal Smoke Abatement Society, he will be supplied with information that will satisfy him.

Mr. Butterfield suggests another form of solid fuel—namely, coke breeze briquettes. But he cautiously adds that the breeze must not contain an excessive amount of ash, which is an impracticable proposition. An additional objection to this, however—quite apart from the fact that there is only a comparatively small quantity of coke breeze made—is found in the fact that you cannot mix pitch with any fuel without having a considerable amount of smoke when burning it. On the other hand, soft coke breeze would contain more volatile, and therefore would require less pitch for briquetting, and in consequence give off less smoke.

With reference to his remarks as to the present low price of pitch and tar, it should not be forgotten that this is entirely attributable to the existing war conditions.

R. Sloane Richards,
Smokeless Fuel Syndicate, Limited.

101, *Leadenhall Street, E.C., March* 24, 1916.

Withdrawing Coke from Stop-End Retorts.

Sir,—I note from the last "Register of Patents" that Messrs. Gibbons and Masters have patented a device for withdrawing coke from stopped-end retorts. It may not be news to them that the identical rake was made by me, and used at the Dorking Gas-Works, some ten years ago. It had other advantages besides mechanical.

S. Carpenter.

Cromer Gas-Works, March 23, 1916.

Ironite on the Concrete Purifiers at Romford.

Sir,—Referring to Mr. Child's paper and the discussion thereon [as reported in the "Journal" for March 21] at the recent meeting of the Southern District Association of Gas Engineers and Managers, we should like to point out—in reply to the question Mr. Glover raised, as to the permanent effect of Ironite—that, when Ironite has thoroughly matured, it remains inert, and is consequently not affected by gases, and acts as an efficient protection to the concrete. We should also like to point out that, should any cracks appear in the concrete, these can be easily repaired with Ironite, applied either internally or externally.

Ironite Company Limited,
per Samuel C. F. Vines, Director.

11, *Old Queen Street, S.W., March* 24, 1916.

The Carbonizing Plant at Southampton.

Sir,—With regard to the latter part of your leader in the "Journal" this week, on the question of verticals, I did not quite catch the President's comment, or should have pointed out that the extension of the carbonizing plant was decided upon in 1912, as stated in my paper. That was four years ago. Naturally, at that date there was not so much known about verticals as since. Even now there are, from what I can gather, constructional defects to be overcome.

Still another point, it was doubtful whether verticals would suit the class of coals we are accustomed to use, without changing for something which would possibly cost more.

I think a few lines should appear in your next issue to point out that the decision for horizontals was made four years ago.

F. Durkin, Resident Engineer and Manager,
Southampton Gaslight and Coke Company.

Southampton, March 23, 1916.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bill brought from the Commons, read the first time, and (pursuant to the Private Legislation Procedure, Scotland, Act, 1899) deemed to have been read a second time, and reported from the Committee: Aberdeen Corporation Water.

Bill read the third time, passed, and sent to the Commons: Burnley Corporation Water.

Imperial Continental Gas Association Bill.

The Unopposed Bills Committee of the House of Lords last Tuesday sent this Bill forward for third reading, subject to communication being made with the Colonial Office respecting it and to any comments of the department. It was pointed out to the Committee that the Association, which was formed in 1870, own undertakings abroad and in the colonies, and generally had powers to hold shares in other similar undertakings. Some doubts have arisen, however, as to the right of the Association to hold shares in other companies, or to dispose of any shares so held; and the Bill now makes the position quite clear. The Association take powers to purchase, lease, &c., gas or other lighting undertakings in the United Kingdom, the Colonies, or foreign countries, and to work in conjunction with other bodies or persons for the same purpose.

HOUSE OF COMMONS.

Uxbridge Gas Bill.

This Bill was down for consideration last Wednesday by a Committee of the House of Commons presided over by Sir W. Howell Davies. Opposition had been entered by the Slough Urban District Council and the Eton Rural District Council; but this was withdrawn, and the Bill has been referred to the Unopposed Bills Committee.

The following further progress has been made with Bills:

Bill brought from the Lords, read the first time, and referred to the Examiners of Petitions for Private Bills: Burnley Corporation Water.

Bill read a second time and committed: Gas Provisional Orders.

Bill read the third time and passed: Aberdeen Corporation Water.

The petitions against the Uxbridge Gas Bill having been withdrawn, it has been referred to the Committee on Unopposed Bills.

The National Pawnbrokers' Association of Great Britain and Ireland, and the North and South Shields and District Pawnbrokers' Protection Association have withdrawn their petition against the Tynemouth Corporation Bill.

Unopposed Bills.

A Committee, consisting of the Chairman of Ways and Means, the Deputy-Chairman, Sir Francis Edwards, Mr. Turton, and Mr. Moon, will meet on Thursday, to consider the following Bills: Plymouth and Stonehouse Gas, Uxbridge Gas, Wakefield Corporation Water.

"Starred" Occupations.

Mr. Cautley, on Tuesday last week, asked the Under-Secretary of State for War whether he was aware that G. F. Evans (single), who, with the assent of his employers, the Lea Bridge Gas Company, attested under Lord Derby's scheme on Dec. 8, 1915, and was placed in Group 9, which was called up early in February, on presenting himself at the recruiting office, was informed that he was not required, on the ground that he was on the "starred" list; and whether he would take steps to see that "starred" men who are willing to serve and not indispensable should be accepted for the Army?

Mr. Tennant replied that the instructions issued to recruiting officers were that they should note carefully, and carry out fully, the protection given to certain occupations by the fact that they have been "starred." A starred man who was willing to enlist and was not regarded as indispensable by his employer could be taken for the Army, provided that the conditions laid down by the Departments concerned were complied with.

Metropolitan Water Board.

Major Newman asked the President of the Local Government Board whether he was aware that a precept from the Metropolitan Water Board had been received by the Southgate District Council showing an increase of over £400 on the precept for the preceding year; whether he could give any reason for this increase; and whether he was aware of the economy that could be effected if the local authorities were allowed to collect the whole of the water-rate?

Mr. Long said that he was aware of the increase referred to, but he might observe that the amount of the precept for the preceding year was abnormally low, owing to special reasons. With regard to the last part of the question, the proposal had been considered by the Metropolitan Water Board, and on Feb. 7, 1913, they passed the following resolution: "That, in the opinion of the Board, it would be impracticable to collect the water charges with the local rates so long as those charges are made upon the water consumers only, and not levied as a public rate upon the ratepayers at large."

Sulphate of Ammonia.

Replying, last Thursday, to Mr. Ginnell, Mr. Runciman stated that he was not in a position to anticipate, with any degree of accuracy, what the demand for sulphate of ammonia would be after the war, or the prospects of its profitable production.

LEGAL INTELLIGENCE.

Lights at a Bye-Products Works.

Martin F. Holliday, the Manager of a North Country Colliery, was charged last Wednesday with not having extinguished the colliery lights on the night of the 5th inst., when there was a Zeppelin raid on the Eastern Counties. It was stated that a notice was sent to him to extinguish all lights, and that some time later he telephoned to the police stating that the men refused to work without lights. The reply was that permission to use lights could not be given; and defendant then said: "I must not endanger the lives of the men working here, and must use my own discretion." Later three arc lights (one not shaded) were observed burning at the ovens. Defendant said there was great danger of the bye-products plant blowing up. For the defence, it was stated that, in view of the danger likely to follow a cessation of work, it was considered justifiable to use subdued light so as to permit of the continuance of the work. Defendant declared that he could not run the risk of forty or fifty men being blown into the air; and he gave instructions for three shaded lights to be used. He considered he chose the lesser of two evils. He was fined the maximum penalty of £100.

Accident to a Workman.

In the Civil Court at Leeds Assizes, last week, a verdict was found for the plaintiff in a case in which R. Sykes, of Batley, sought damages from the Yorkshire Iron and Coal Company, Limited, in respect of an accident to one of the plaintiff's workmen in May, 1914. The plaintiff's workmen were erecting gas-purifiers at the defendants' works at Ardsley; and the allegation was one of negligence in gas being allowed to escape, as the result of which a workman was overcome, and fell from the internal scaffolding, breaking his spine. The defence was a total denial of responsibility.

Claim Arising out of an Accident.

At the West Riding Assizes, Mr. Justice Sankey and a Jury had before them an action which raised the question of who was responsible in law for causing the death of a workman at Penrith. The action was for damages for alleged negligence, brought by Drakes Limited, against William Grisenthwaite, a builder, of Penrith. From the statement of claim, it appeared that on Dec. 8, 1914, in the course of erection work at the Penrith Gas-Works, a man named Steward, employed by plaintiffs, was accidentally killed. The plaintiffs admitted liability under the Workmen's Compensation Act, and paid £300 to the widow. This sum, together with costs, the plaintiffs sought to recover from the defendant, on the ground that the accident was caused by the negligence of the defendant's servant. Mr. Tindal Atkinson, in opening, said the defendant was putting up the brickwork of a retort-house at Penrith; and the plaintiffs were erecting the steel roof of the house. Defendant had fixed a scaffold, with a platform about 30 feet from the ground. One of his men was engaged in carrying stones in a hod up a ladder to the platform; and when he arrived with one load he stood the hod against a steel stanchion, and commenced to unload it. While he was doing so, the hod shifted, and a piece of stone fell on to Steward, who was working on the ground below. It struck him on the head, killing him practically instantaneously. The plaintiffs alleged that the defendant was negligent in not providing a guard board, tarpaulin, or other protection against falling stones or bricks. The defence was a denial of negligence. The Jury returned a verdict for the plaintiffs.

MISCELLANEOUS NEWS.

AUSTRALIAN GASLIGHT COMPANY.

The Half-Yearly Meeting of the Company was held in Sydney on the 10th ult.—Mr. G. J. Cohen in the chair—when the Directors reported that the profits for the six months ended Dec. 31, with the balance brought forward, amounted to £67,352. A dividend for the six months was recommended at the rates of 7 per cent. per annum on the "A" and "B" shares and 6 per cent. on the "C" shares. The Directors decided last August to increase the capital by the issue of 50,000 "C" shares of £6 each; but, in view of existing conditions, they have for the present postponed further action. The Necessary Commodities Control Commission had been holding an inquiry into the price of gas. No final decision had been come to; but there was every reason to believe that, when the whole of the evidence had been submitted, the present rate would be maintained. The industrial agreement with the Gas Employees' Union having expired, the Wages Board appointed under the Industrial Arbitration Act were sitting with the view of making a fresh award.

The Chairman said the operations during the period under review showed signs of improvement in several directions, the exception being the slight decrease in the consumption of gas, due principally to conditions occasioned by the war, which had undoubtedly caused economies in domestic affairs in which the use of gas played so important a part. Much to the regret of the Directors, the Necessary Commodities Control Commission, in September last, intimated their intention of holding another inquiry into the price of gas. The matter in due course came before the Commission; but the case not having been completed by the end of the year, it was postponed for a time. The Board naturally thought that the previous decision of the Commission on this subject would have been allowed to remain in force until after the war—particularly as the recent Gas Act contained special provisions for regulating the price of gas. A question had been raised as to whether, owing to this Act, the Company came within the scope of the Commission. The industrial agreement with the Company's workmen having expired, notice was received in September last that it was the men's intention to apply to the Wages Board for a new agreement, and an award as regards wages. This application was receiving the attention of the Wages Board, whose decision was being awaited with much interest, seeing that, if the claims were granted, the cost of production would be materially increased. The proposal to augment the capital by the issue of 50,000 "C" shares was fully considered by the Board; but, having been assured by the best financial authorities in the city on these matters that the present time was inopportune to call up so large an amount of capital in face of the Commonwealth War Loan, the Directors reluctantly deferred further action, though it was imperative that more capital should be raised. There was a new item appearing in the balance-sheet under the heading of general charges—"allowances to employees on active service." This expenditure, he felt convinced, would appeal to the shareholders, under the circumstances connected with the disastrous war. The Company's "Roll of Honour" contained 226 names, including 20 of the clerical staff. He regretted having to report the death of seven at the front, and that others had been incapacitated by wounds and illness. The remaining members of the staff were loyally carrying out the increased work devolving upon them. Regarding the public lights, these had increased during the past year by 91; the total number now in use being 7355. The usual increase in sales of gas-cookers, which was somewhat checked at the commencement of the war, was now being gradually overtaken; the total number disposed of to date being 41,712, an increase of 1664 for the half year. The increase in the number of consumers for the period under review was 3582; the total being 129,440. Ninety miles of mains and services had been laid during the past six months. He was glad to be able to report that the long-outstanding claim against the Government with regard to the amount of compensation to be paid to the Company in respect of the resumption of their property in Kent Street had at last been settled. An agreement was come to by which the whole matter was referred to arbitration; and it was decided that this should be conducted without legal representation—the Board being largely influenced in agreeing to this course by Mr. P. T. Taylor (the Deputy-Chairman) consenting to take upon himself the burden of conducting the case on behalf of the Company. So successfully had he done so that the Arbitrators had awarded the sum of £535,000 to be paid to the Company. The proceedings had been very lengthy; and the preparation of the case on behalf of the Company, under the supervision of Mr. Taylor, had entailed an immense amount of labour on the part of the Secretary (Mr. R. J. Lukey), the Acting-Engineer (Mr. Andrew Wilson), and the other members of the staff. Mr. Taylor conducted the matter with great thoroughness and tact; and he (the Chairman) would ask them to tender him a hearty vote of thanks for his valuable and successful services, and request him to accept such remuneration as the Board might think proper.

The report was adopted, the dividends recommended were declared, and a special resolution of thanks to Mr. Taylor was passed.

The arbitration referred to by the Chairman had reference to the taking of certain land in the possession of the Company, for the construction of a road and wharves by the Harbour Trust. The Arbitrators were Mr. J. N. Reeson (Chief Engineer to the Melbourne Metropolitan Gas Company) and Mr. P. C. Holmes Hunt. Mr. F. Leverrier, K.C., was appointed Umpire in case of disagreement between the Arbitrators; but his services were not requisitioned.

KINROSS GAS-WORKS PURCHASE.

The proposed arbitration for the purchase of the undertaking of the Kinross and Milnathort Gaslight Company by the Kinross Town Council has now been departed from, and a settlement arrived at between the parties. The Council on June 10, 1914, served upon the Company a notice to treat in terms of section 21 of the Burghs Gas Supply (Scotland) Act, 1876; and the Company, on Aug. 6, 1914, intimated to the Council their willingness to treat. The Council and the Company thereafter appointed arbiters. In consequence of the financial situation due to the outbreak of the European War, it was deemed advisable that the arbitration should not further proceed; and the parties have now adjusted the terms of agreement.

The Town Council, with consent of the Company, withdraw and cancel the notice to treat. The Town Council further bind themselves not to serve a new notice to treat upon the Company, or take any proceedings in virtue of the powers conferred upon them by the Burghs Gas Supply (Scotland) Act, 1876, with respect to the acquisition of the undertaking of the Company for a period of seven years from and after the 10th of June, 1914. The Company, in consideration of the obligation given by the Town Council, withdraw all claims against the Town Council in respect of the expenses which have been incurred by the Company in connection with the notice to treat. The Gas Company, therefore, will pay their own expenses, the Town Council meeting their expenses, including that of the arbiters and oversman.

The matter is of interest, having regard to the fact that this is probably the first instance of an arbitration of the kind in Scotland being departed from—due to the present financial situation.

TRIBUNALS AND EXEMPTION APPLICATIONS.

The Felixstowe Gas Company applied to the Military Service Tribunal for the exemption of their head clerk and their only fitter. It was stated that the clerk had now to take charge, in the absence of the Secretary and Manager (Mr. F. Paternoster), while the fitter was the only one remaining out of four who were usually employed before the war. The recruiting officer stated that the clerk was not employed inside the works, and therefore the claim could not be entertained. It was suggested that the Company might find a competent woman to take the place of the clerk, and that temporary exemption should be granted for six weeks to enable the Company to try and fill his place. As to the fitter, conditional exemption might be granted. The clerk also applied on the ground of financial hardship, and that he had a delicate wife and three children. The Tribunal agreed to the suggestions stated.

Before the local Military Service Tribunal, the Tynemouth Gas Company appealed for the exemption of one of their employees—a plumber. The Secretary (Mr. J. J. Carr) pointed out that the man, who was an expert in adjusting meters, &c., was in a reserved occupation, and that the Company had already parted with as many men as they could spare. The military representative offered no objection to conditional exemption so long as the man remained in his present employment, and on the understanding that he joined the Volunteer Training Corps. The Tribunal agreed to this.

Mr. David Terrace, the Gas Engineer and Manager to the Middlesbrough Corporation, applied to the County Tribunal, sitting at Middlesbrough, last Friday for the exemption of a gas-meter fitter. The Clerk pointed out that the man was not in any way employed in the manufacturing of gas or on work in connection with bye-products. The Chairman: You will have to do with a less number of employees. Mr. Terrace: Well, the consumers will have to suffer, that is all. There are 25,000 consumers. It was stated that 50 per cent. of the gas-works employees had enlisted. The decisions in individual cases were not divulged. With reference to another Gas Department employee, it was stated previously that he had been engaged in the preparation of plans for extensions and alterations; but the Clerk pointed out that the Gas Manager had now abandoned this plea, and said that the man was employed in dealing with the settlement of a gas-tank.

Alfred J. Lemmon, an engine driver in the service of the Dorking Water Company, who has charge of valuable pumping plant, was granted conditional exemption at last Wednesday's sitting of the local Tribunal.

Exemption was applied for on behalf of a prepayment meter collector at Malvern, on the ground that it was in the national interest that he should be kept at his work. He was put back until June 30, to enable him to balance his books.

The Woking Water Company applied for the exemption of the following men on the ground that they were indispensable: Alfred Aldridge (waste inspector), Arthur Howard (internal pipe fitter), L. Privett (engine driver), and F. Day (engine driver and stoker). In the case of the first three, it was stated that the men were married and unattested, whereupon the Chairman remarked that they were "as free as the birds in the air." Day was granted three months' exemption.

At Oxford, Ronald S. B. Goodsell appeared before the Tribunal, and declared that he had a conscientious objection to all work connected with war. When he made his appeal, he was Gas-Works Manager at Shipton-under-Wychwood, under the United District Gas Company; but now he was helping to re-model the works at Wadhurst. His father was the Manager of the Charlbury and the Shipton Gas-Works, and he assisted him. He was himself made Manager of the Shipton Gas-Works in 1914. The application was refused.

The Braintree and Bocking Gas Company applied for exemption for two gas-fitters, who also inspected meters. It was stated that the Company had already lost four fitters, who had joined the Colours; and the services of these two men were indispensable, and necessary in the National interest. One man was allowed until July 1, and the other until July 31.

Before the local Military Tribunal on Friday, the Manager of the Brierley Hill Gas Company (Mr. W. C. Jones) applied for temporary exemptions for two employees—a month in one case, and two months in the other. He explained that the Company had 6000 meters; and these two men were chiefly engaged as inspectors and slot-meter collectors. Women were being trained to do work previously done by men. The Tribunal granted the exemptions asked for.

Application was made by the Richmond (Surrey) Gas Company for the total exemption of a number of their employees. Mr. T. May (the Secretary and Engineer) stated that over 50 per cent. of the Company's men had joined the Colours, and they were paying £1100 a year in allowances to dependants. The Advisory Committee recommended that nearly the whole of the men in the list should be exempted; and the Tribunal confirmed this recommendation.

* * *

Christchurch (N.Z.) Gas Company.—It is stated in the annual report of the Company that seventeen members of the staff have joined the Colours. The positions of these men are being kept open; and they are receiving half-pay. A dividend of 5 per cent. is recommended, in addition to the interim dividend already paid. The receipts for the year amounted to £104,242, and the expenditure to £72,722, leaving a profit of £31,520. The Directors say they are glad the report is so satisfactory, despite the competition of electric light and the heavy war taxation. The paid-up capital stands at £235,075, and the assets are valued at £408,043.

Bexhill Water and Gas Company.—The half-yearly meeting of the Company is being held to-day at the Cannon Street Hotel, E.C., when the Directors will report a balance at the credit of the profit and loss account available for dividend of £7869. They will recommend a dividend at a rate of £6 10s. per cent. per annum on the £34,000 of capital authorized by the 1885 and 1892 Acts, and at the rate of £4 11s. per cent. per annum on the capital of £123,710 authorized by their later Acts and Provisional Order. This, with provision for income-tax, will leave £3949 to be carried forward. The increase in the total revenue is considered to be satisfactory; but "the expenditure has been abnormally increased owing to the war and the rise in wages and the price of every commodity used by the Company." The Board propose to get the rescission of a resolution passed in 1908 regarding the increase of capital, and ask the shareholders to sanction the creation of £120,000 of new ordinary and preference capital—not more than half to be of the latter class.

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DAVIS GAS-STOVE COMPANY, LIMITED.

The Sixteenth Annual General Meeting of the Company was held last Friday, at the Cannon Street Hotel, E.C.—Mr. H. ADDIS PRICE, the Chairman, presiding.

The CHAIRMAN, in moving the adoption of the report [*ante*, p. 651] and statement of accounts, said that, considering the circumstances, it was satisfactory that the Company were in a position to pay a dividend of 10 per cent. for the year on the ordinary shares. They had had a very strenuous and anxious year; the difficulties including, not only shortage of labour and the consequent necessity for paying increased wages, but continually increasing prices of all raw materials. They had certainly obtained enhanced prices for their goods; but these had not been nearly commensurate with the higher cost of production. This accounted to a very large extent for the diminution of profit compared with that of the previous year. The Directors, in addition to pensions paid to retired employees, had felt it their duty to contribute liberally to the suppert of the dependants of employees who have responded to the country's call for men; and in view of the fact that nearly £3000 has been expended for this purpose, he would ask them to set aside out of the profits for the year a further sum of £3000 to be placed to the credit of the provident fund. That there would be urgent calls upon this fund would be apparent, when he told them that practically one-half of the total number of the Company's regular male employees had joined the Forces. It would be noticed that the Directors had not this year made any allocation to the general reserve, which already stood at the substantial figure of £62,500, and was the equivalent of the preference share capital. In view of the present trade uncertainty, and the equally difficult times ahead, the Board had felt it wiser (after providing for the contribution of £3000 to the provident fund) to carry forward the whole of the remaining balance to the credit of the current year's profit and loss account.

Mr. HAROLD N. DAVIS (one of the Managing-Directors), in seconding the resolution, remarked that though it would not be prudent for him to give details of the munitions of war of which the Company had undertaken the manufacture, the shareholders might be interested to know that they had created several entirely new departments for this purpose—departments which they had every reason to believe they would be able to keep occupied in times of peace. In these departments, in addition to the men, they had some hundreds of women and girls employed, who had been trained in what before the war were considered skilled trades. The successful adoption of female labour had enabled the Directors to carry out, beyond the most sanguine expectations, their policy of releasing as many men as possible for the Army. There seemed to be an erroneous impression abroad that contracts for war material were yielding enormous profits; but people seemed to forget that the Ministry of Munitions comprised many of the ablest financial and business men of the country, and, whatever might have been the case in the earlier days of the war, for some time past contracts had been placed at prices which left the manufacturers a very small margin of profit. In saying this, he wished to pay a tribute to the Ministry of Munitions for obtaining what was required at the lowest possible cost to the country. The Company had for many years manufactured gas appliances for industrial purposes; but for some time past they had been carefully investigating new systems for the application of gas to such operations. They were now completing considerable extensions of the Industrial Appliances Department, which would enable them to cope with the rapidly growing demands for appliances constructed on the systems they had adopted. This branch of the business had been a fast expanding one; and it was one for which the Directors predicted a splendid future. The gas-stove section had been busily engaged during the year on large cooking and heating apparatus for military hospitals, camps, munition works, &c.; and the Company received the order to supply the whole of the gas cooking apparatus for the King George Hospital—the largest military hospital in the country. The staff had most loyally assisted the Directors in carrying on the business during the most difficult and arduous year in the Company's history.

The report was adopted, and a dividend making (with the interim payment) 10 per cent. for the year, less income-tax, was declared on the ordinary shares.

GAS AND METER TESTING IN LONDON.

There are contained in Vol. I. of the report of the London County Council for 1914, lately issued [four volumes are required to complete the report], particulars with regard to the tests of gas carried out during the twelve months. The results of the daily tests made at the official stations in the year ended Dec. 31, 1914, were:

Name of Company.	Average Illuminating Power (Standard, 14 Candles).	Average net Calorific Power.	Average Number of Grains of Sulphur in each 100 Cubic Feet of Gas.	Number of Statutory Deficiencies.
Gas Light and Coke .	14·24	120·4	33·6	20
South Metropolitan .	15·30	125·0	18·4	—
Commercial	14·45	120 2	30·3	1

Proceedings were taken against the Gas Light and Coke Company in respect of deficiency in illuminating power on twenty occasions. Forfeitures, amounting in all to £29, were incurred in three cases; and seventeen reports were cancelled. Proceedings were taken against the Commercial Gas Company in respect of deficiency in illuminating power on one occasion. The report was, however, cancelled. Results of tests made with the portable photometer were: Gas Light and Coke

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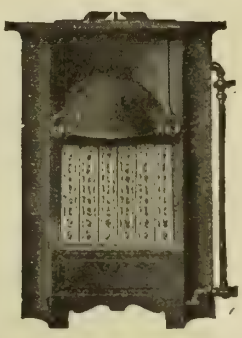

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Company, 31 tests, average 13·86 candles; South Metropolitan Company, 10 tests, average 14·63 candles; Commercial Company, 20 tests, average 12·95 candles; Wandsworth, Wimbledon, and Epsom Company, 10 tests, average 13·07 candles; Brentford Company, 10 tests, average 14·70 candles.

Under the provisions of the Gas Light and Coke Company's Act, 1914, which came into force on Jan. 1, 1915, the Company are no longer under any obligation to supply gas of a prescribed illuminating power. The standard illuminating power and also the standard calorific power prescribed in the Act of 1909 are replaced by a standard calorific power of 540 B.Th.U. gross [1 calorie = 3·97 B.Th.U.]; but the Company are not liable to forfeitures for deficient calorific power, unless it falls below 499·5 B.Th.U. on any one day. The tests for illuminating power by means of the flat-flame burner prescribed by the London Gas Act, 1905, are to be continued, and are to be made when the controlling authority directs; but the Company will not be liable to any penalty in respect of deficiency of illuminating power. The following are results of some tests of the net calorific power of the gas of the different Companies: Gas Light and Coke, 30 tests, average net calorific power, 119·4 calories; South Metropolitan, 10 tests, average 123·7 calories; Commercial, 20 tests, average 117·6 calories; Brentford, 10 tests, average 119·6 calories. In the case of the Wandsworth Company, 10 tests gave an average gross calorific power of 134·2 calories.

Under the Sales of Gas Acts, 1859 and 1860, and the Metropolis Gas Amendment Act, 1861, provision is made for regulating the measures to be used in the sale of gas, and for the appointment by the Council of inspectors to test meters in the County of London (excluding the City of London). The Council have four gas-meter testing offices. At each of these there is a senior inspector with a staff of assistants, who test all meters brought for the purpose; a fee being charged for each meter according to the scale fixed by the Act. The total number of meters submitted for testing during the year 1914 was 248,074, of which 208,518 were stamped and 39,556 rejected. In consequence of the large increase of the work during recent years, it has been found necessary during the year to put in hand the enlargement of the Newington gas-meter testing-office. The holders at the Westminster testing-office also were renovated and re-verified during the year.

Price Raised at Southend.—The Southend Gas Company announce that, in consequence of the advancing prices of raw materials, the charge for gas will be increased by 4d. per 1000 cubic feet from the next reading of the meters.

Rhymney and Aber Valleys Gas and Water Company.—It was stated at the annual meeting of the Company that, owing to the war, the new gas-works at Caerphilly would not be completed as early as had been expected; but it was hoped they would be quite finished by next winter. The revenue account showed a profit for the year of £18,518. A dividend of 5 per cent. was declared on the preference and ordinary shares.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *March* 27.

The position as regards pitch remains about the same as last reported. A fair amount of business continues to be done, both for home and export; and the price is steady at 19s. to 19s. 6d. per ton net at sellers' works. In other products, values are as follows: Creosote, 4d. to 4⅛d. per gallon, in bulk; 90-160 solvent naphtha, 2s. 2d. per gallon, naked; 60's crude carbolic acid, 3s. 4d. per gallon, in sellers' tank trucks; pure toluol, 3s. 4½d. per gallon, naked; pure benzol, 1s. 7d. per gallon, naked—all at makers' works, net cash. The last mentioned three products are, of course, entirely under Government control.

It is reported that export licences for sulphate of ammonia will now be granted more freely; the farmers not having taken the large quantities anticipated by the Government. With the more general resumption of exports, a firmer tone is to be expected. Stocks are not unduly large, as shipments made against old licences in hand have tended to keep these within reasonable limits. The prompt value of 25 per cent. quality is £17 5s. per ton net, into buyers' bags, at makers' works.

Tar Products in the Provinces.

March 27.

There is no alteration in the markets for tar products. Creosote is still quiet, and business is very difficult in this article. There appears to be a great deal of solvent naphtha offering. Heavy naphtha is in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 16s. to 20s. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2½d. to 2⅝d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *March* 25.

During the past week there has been no new feature to comment upon in the market for this article, and only slight fluctuations have taken place in values. The inquiry has been less than it was last week, but there has not been much pressure on the part of producers to effect

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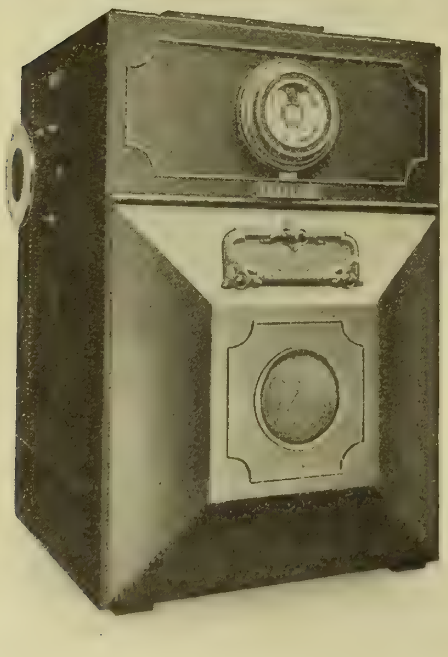

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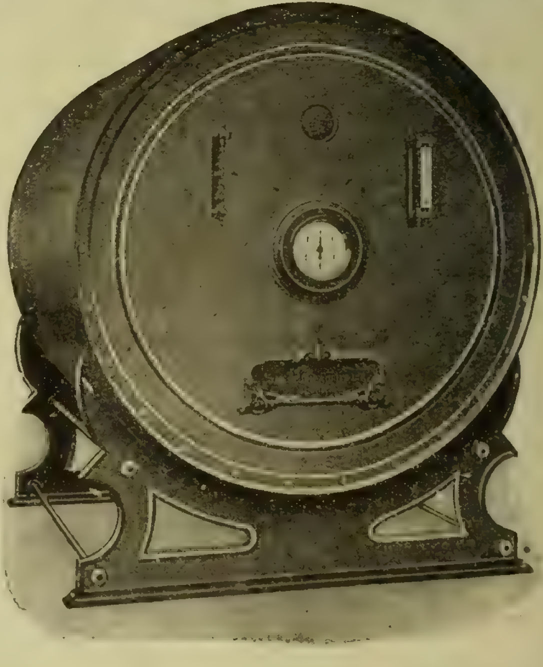

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sales. At the close the quotations are still £16 17s. 6d. per ton f.o.b. Hull, £17 f.o.b. Liverpool, and £17 2s. 6d. f.o.b. Leith. The forward position has remained quiet, but it has transpired that a little business has been done for April-September delivery at a premium on prompt prices.

Nitrate of Soda.

The spot market for this material has been well maintained, and prices are now 17s. 3d. per cwt. for ordinary, and 18s. 3d. for refined quality.

Sulphate of Ammonia.

From another source it is stated that outside London makes are quoted at £15 17s. 6d.; Hull, 16 12s. 6d.; Liverpool, £16 15s.; Leith, £16 17s. 6d.; Middlesbrough, £16 15s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

Though steamers are still scarce, yet there is a fairly good shipment of coal from the north-eastern ports, and there is also a very strong demand for most classes of fuel. This fuller export has had the effect of stiffening the prices, though this is more shown for the forward supplies. In the steam coal trade, prompt supplies are not so easy to obtain, and values are well maintained. Best Northumbrian steams are steady at 32s. 6d. to 34s. 6d. per ton f.o.b.; second-class steams are about 29s. to 30s. per ton; and for steam smalls the prices are firm at 16s. to 20s. per ton. The production is good when the depleted staff at the collieries is borne in mind, as well as the considerable amount of short time that is being worked—partly unavoidable. In the gas coal trade, requirements are still heavy, and the output is readily taken up, though the consumption must now be decreasing as the days lengthen. For best Durham gas coals, about 25s. 6d. per ton f.o.b. is the current price; for second-class gas coals, 24s. per ton; while "Wear Specials" are 27s. per ton f.o.b. In a few instances, where prompt steamers have been found, slightly less may have been taken; but the market seems steadier. A little is being done in contracts. The details, however, do not readily transpire; and they are not expected to vary much from the prices under parliamentary enactment. The high freights continue. Gas coal from the Tyne to London is nominally about 16s.; and to Genoa, it is close upon the record rate of £5 per ton. At the same time, much coal is being carried under lower rates, previously arranged; but tonnage is scarce, and much of that supplied is that of neutral steamers. Coke is steady, with a good demand. Gas coke seems to show a little ease, though the exports are tolerably full. Good gas coke is now quoted from 26s. 6d. to 28s. per ton f.o.b. in the Tyne.

Auckland (N.Z.) Gas Company, Limited.

The report adopted at the fifty-fourth annual meeting of the Company, held last month, stated that the profit for the twelve months ended Dec. 31, after deducting working expenses, cost of repairs and renewals, management expenses, interest, and other charges, amounted to £61,837. Adding the balance in hand, and deducting the interim dividend paid in July, there was an available sum of £64 935, out of which the Directors recommended the payment of a dividend for the past half year of 11d. per share on the £1 fully-paid shares, and a proportionate amount on the £1 contributing shares (7s. paid). The Chairman (Mr. J. H. Upton) said the accounts were such as to entitle the shareholders to congratulate themselves on the year's operations. General charges were more, owing to the fact that they had subscribed £2000 to the patriotic fund, and £250 to the hospital ship. For the first time in many years, the sale of gas showed only a slight increase; but there had been a large increase in the number of consumers. The obvious inference was that general economy in expenditure was being practised by the people. The price of gas in Auckland was the lowest in New Zealand, and except in Sydney the lowest in Australasia. Of the staff, 47 had responded to the greatest call that could be made on any of them, and had volunteered for service against the enemy. The Directors sincerely hoped they might all come back; and should this be their good fortune, they would find a warm welcome, and their old positions, or better ones, open for them. The Company had now taken the sale of coke to the public into their hands, and were selling more than they made, so that the stocks were being steadily reduced.

Middlesbrough Gas Supply.—At a meeting of the Middlesbrough Corporation Gas Committee last Tuesday, it was stated that the gross estimated profit on the gas-works for the past year was £22,502. It was also reported that, for the first time for nearly eighteen months, there had been an increase in the consumption of gas. The amount sent out during February was 45,565,000 cubic feet, which was an increase of 3,350,000 feet.

Monte Video Water-Works Company.—The Directors' report for the year 1915 states that the net receipts amounted to £120,492, or £2805 more than in the preceding year. The payment is proposed of a final dividend of 5 per cent., making 8 per cent. for the year, less income-tax. After allocations to the reserve, depreciation, and staff provident funds, there will be a balance to carry forward of £56,543. The ratio of working expenses during the year was 33·1 per cent., as against 33·75 per cent. in 1914. The Directors point out, however, that it will be difficult to prevent an increase in the ratio during the current year, owing to dearer fuel and materials, and local legislation restricting the hours of labour. The severe crisis in Monte Video has recently shown signs of diminishing, with the result that the Company's business has expanded, and the revenue been maintained.

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Broadstairs Gas Company.

At the annual meeting of this Company last Thursday week unusual interest was shown in the proceedings, undoubtedly due to the reduction in the profits for 1915 notwithstanding that the price of gas was 9d. higher for a great part of the period under review. After the usual preliminaries, the Chairman introduced the report and accounts. Mr. R. W. Edwards, of Aldershot, moved an amendment that the report should not be adopted, and that the meeting should be adjourned, and a Committee of Shareholders appointed to investigate the affairs of the Company, with power to engage the services of an expert at a fee not exceeding fifty guineas in due course, and submit a report to the shareholders. This amendment was lost; whereupon a motion was proposed that the dividends recommended in the Directors' report be not paid. This was carried. In the discussion on the report, several matters of vital importance were revealed, which a section of the shareholders still think must be further looked into and a general reorganization of the Company's affairs effected. It is possible, we learn, that a body of shareholders may take further action unless the Board agree to a radical reorganization, which can only be effected by securing an expert's advice and introducing suitable reforms. Two new Directors, known locally, were elected to the Board.

* * *

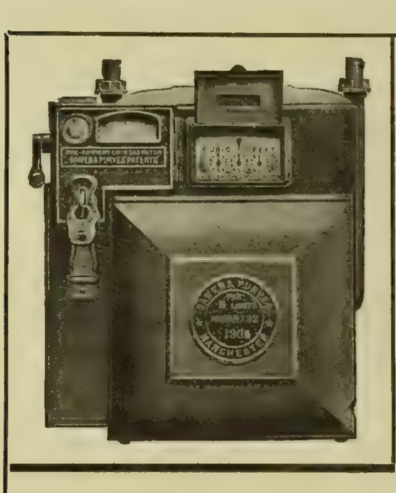
Dublin Gas Company v. Blackrock Council.—A meeting of the Blackrock (co. Dublin) Urban District Council have considered threatened legal proceedings by the Alliance and Dublin Consumers' Gas Company, respecting their agreement for the public lighting of the township. After a discussion in committee, a recommendation was adopted that the Law Agent be instructed to enter an appearance on the writ served by the Company.

Price of Gas at Hebden Bridge.—A proposal to consider the question of advancing the price of gas to consumers was brought forward at a meeting of the Hebden Bridge and Mytholmroyd Gas Board last week—Mr. James Simpson, J.P., in the chair. Immediately the matter had been raised, it was moved and seconded that the question should be discussed in committee. Mr. B. Grindrod disagreed. He thought the time had come when the public should know more of the difficulties the Board had to face. In view of the increased cost of material, it was thought by those who understood gas manufacture that for every shilling put on coal the price of gas should be increased one penny. In his opinion, the time had come when the Board should put up the price of gas. Mr. A. Sutcliffe stated that he had no fear as to publicity, but he did not consider the present an opportune time to increase the price. They should at least wait until the end of the financial year, and see how they stood, before deciding anything. He was opposed to any advance at present. The resolution for privacy was carried. In committee, however, a motion to advance the existing rate of 3s. per 1000 cubic feet for ordinary consumers, and a graduated lower scale for power purposes, was defeated.

Halifax Municipal Trading Profits.—A statement of profits on municipal undertakings during the past year, submitted to the Halifax Town Council, showed that the total on all the trading undertakings was £53,058, of which £22,689 was paid by the gas-works. The electricity undertaking contributed only £14,353. Owing to the darkening of the streets, it was mentioned, £5742 was saved on public lighting.

Gillingham Corporation Electrical Undertaking.—The following reference to the electrical undertaking of the Gillingham Corporation appears in the "Chatham, Rochester, and Gillingham Observer:" It cannot be said that the estimates with regard to the electric light undertaking make pleasant reading. The repayment of principal and interest during the ensuing six months will absorb £3659, expenditure on coals and other bills £2660, rates, taxes, &c., £22, and salaries and wages £1375—making a total of £7716. Against this the income is estimated at £4154, leaving a deficit of £3562 to be met from the rates. This is practically equivalent to a 5d. rate. In other words, the non-users of the electric light have to bear a large proportion of the cost of producing the current. The position is far from satisfactory. At the present rate of progress many years must elapse before the undertaking gets to the self-supporting stage. Those who were responsible for the purchase of the works anticipated that in the course of a few years a profit would be shown; but such a rosy view has been entirely falsified. It need hardly be said that had a private company been running the undertaking on precisely similar lines it would have been in bankruptcy long ago."

Lord Provost of Edinburgh on "Salesmanship."—Last Friday, the Lord Provost of Edinburgh (who is Chairman of the Gas Commissioners) gave an interesting address on "Salesmanship" to a meeting of the Edinburgh and East of Scotland Association of Goldsmiths, Silversmiths, and Watchmakers. The vital part of business, he remarked, was the sale. The method of selling which was the most economical, progressive, successful, and profit-making was the one which should be used. The successful salesman must be inwardly and outwardly in harmony with the goods he sells. The temperament of the customer had to be considered. Diplomacy in speech was always to be commended till the salesman knew his customer; thereafter he would naturally adopt the attitude which would appeal to the temperament of the customer. Many a salesman was a failure because he was not adapted to his work. "Bluff" might be part of salesmanship; but everlasting "bluff" never made a salesman successful. Customers liked to be waited on, and demanded some flattery. Essentials were judgment, memory, desire to serve, honesty, truth, enthusiasm, tact, decision, and action. A glib tongue was apt to breed suspicion. Salesmanship was the power to persuade people to purchase at a profit. The salesman was not only born but made; and the successful salesman was the man of thought, culture, and usually of study. He had always found he could do business with Americans because he tried to kill them with kindness.



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Devon Gas Association.

The tenth annual meeting of the Association was held last Thursday, at Exeter. The Chairman (Mr. F. Templer Depree, J.P.), in moving the adoption of the report, said the past year had been one of exceptional difficulty to all gas companies. In their case, the price of coal had increased at least 40 per cent. over the average price for the previous five years, which, in itself, was a formidable difficulty. It had been met, to a small degree, by an increase in the price of gas; and he thought the shareholders would be quite agreeable to sharing with the gas consumers a portion of the burden, by accepting 4 per cent. dividend, instead of the 5 per cent. they had hitherto received. The difficulty in disposing of tar, and the Government ban on the sale of crude tar, had occasioned a decrease in the revenue; but the Company hoped to meet this by the erection of a small dehydration plant, which would render the tar saleable for road purposes, and enable them to extract the light oils necessary for high explosive purposes. The outlook was uncertain; but he felt assured that the ultimate prospects of the Association could be looked forward to with every confidence. Mr. R. J. Rew seconded the motion; referring to the improved working results, and expressing the opinion that 5 per cent. would be paid again on the return to normal times. The report was adopted.

A Badged Gas Stoker and the Tribunal.

Correspondence which had passed between the Ministry of Munitions, the Shotley Bridge Gas Company, and the Benfieldside Tribunal, relative to the case of a gas stoker who had been refused exemption, was read at a sitting of the Tribunal last week. In reply to a letter from the Gas Company drawing attention to the case, the Ministry said the Company had made a great mistake in allowing their badged employees to go before the local tribunals. Fox was exempted by his badged certificate, in spite of the decision of the Tribunal; and if he received a notice paper summoning him to the Colours, the Ministry's instructions should be followed out exactly. Mr. J. B. Lazenby (Clerk to the Tribunal) had explained in a letter to the Ministry that, prior to December, the man was in a situation as a groom; but when he left that place, he became a gas stoker. The Tribunal thought, rightly or wrongly, that the Gas Company ought to, and could, if they liked, get a man over military age to do stoking work. The Ministry of Munitions, in a further letter, said that as the man was badged, his certificate of exemption could only be withdrawn by the Ministry, and suggested that the military representative should apply for a review of the certificate. The military representative said he would take the matter up with the Ministry.

Reduction in Price at Bo'ness.—At Bo'ness, the price of gas has been reduced from 3s. 9d. to 3s. 4d. per 1000 cubic feet. The consumption of gas during the past eight months has increased; and this has led to the present reduction.

Wrexham Gas Company.

It was stated by the Chairman (Mr. J. Oswell Bury), at the annual meeting of the Company, that it was proposed to increase the price of gas a further 3d. per 1000 cubic feet, making the net charge 2s. 9d. Since the beginning of the war, the price of coal had increased more than 35 per cent., lead pipe 78 per cent., wrought-iron tube 41 per cent., copper goods 60 per cent., brass fittings 50 per cent., burners 50 to 60 per cent., and glass, in some cases, 150 per cent. One effect of the increase in the price of gas was the automatic decrease in the bonus payable to the employees under the co-partnership scheme; and this the Directors greatly regretted. Revenue receipts showed a total increase of £3467, compared with 1914; the total being £26,737. The increased sale of gas (due principally to billeting in the district) was equal to nearly 12 per cent. Expenditure on revenue account was £21,636, as against £18,161. The total sum available for dividends was £9162. Fourteen of the employees were serving their country, as well as one of the Directors; and every man of military age with the Company had attested. Under the "free labour" system of burner maintenance, nearly 58,000 burners were attended to last year. To replace losses, two young women had been engaged for maintenance work, with satisfactory results. The report having been adopted, a dividend at the rate of 2½ per cent. for the half year was declared, making 5 per cent. for the year.

Torquay Gas Company.—The annual meeting of the Company was held last Thursday week—Mr. A. Iredale presiding. The report submitted stated that there was a credit balance of £9679. The Chairman referred with satisfaction to the fact that Mr. R. P. Kitson, who presided over the meetings prior to the war, had been promoted to the rank of Major. They had, he said, had a record year, both in the matter of income and expenditure. Coal had cost them £18,299, against £14,720 in 1914, an increase equal to 31 per cent. They had received £1000 more from coke; and the revenue from the sale of gas had increased from £25,427 to £30,539. The report was adopted.

North Shore (Sydney) Gas Company.—That the business of the Company during the past year had in some respects been fairly satisfactory, was the comment of the Chairman (Mr. P. T. Taylor) at the recent annual meeting. Instead of the rate of increase being, as in former years, from 12 to 15 per cent., it had fallen to 3·61 per cent.; and there were indications that during the present year the output of gas would not be so much as that of last year. About eighty men, including six from the office staff, had joined the Colours. The construction of the Oyster Cove works was being proceeded with; but, unfortunately, owing to the war, certain portions of the work were at a standstill. The total number of consumers was 17,525; and the output of gas last year was 724,482,394 cubic feet. After the report had been adopted, dividends were declared for the half year at the rates of 3¼ per cent. on the "A" shares and 3 per cent. on the "B" shares, making 6½ and 6 per cent. for the year.

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Increase at Huthwaite.—Following the example of many other Nottinghamshire authorities, the Huthwaite Urban District Council at their meeting last Tuesday, decided to raise the charge for gas to ordinary consumers 6d. per 1000 cubic feet. The prepayment meters are to be altered so that less gas will be given for a penny.

Increase in Price at Hull.—Public announcement has been made by the British Gaslight Company, at Hull, that the price of gas, in consequence of the greater cost of production, will be raised to 2s. 4d. per 1000 cubic feet from the end of the present quarter. This is the second advance of 3d. made since the outbreak of the war; the pre-war price having been 1s. 10d. per 1000 cubic feet.

Financial Results of the Panama-Pacific Exposition.—In the current month's number of the "American Gas Institute News" the Secretary (Mr. George G. Ramsdell) remarks: The Panama-Pacific Exposition, for probably the first time in history, reversed the usual custom and closed with a surplus instead of a deficit. The gas industry may well feel proud of the fact that the "Collective Gas Exhibit" followed the lead of the exposition, and also closed with a surplus of $311·53. The Gas Exhibit Committee unanimously voted that any surplus funds should be equally divided between the American Gas Institute and the Pacific Coast Gas Association; and the balance referred to has now been handed over.

Nottingham Gas Undertaking.—The substantial part which the Nottingham gas undertaking has played in the alleviation of municipal burdens was pointed out by Alderman Sir John Turney at a special meeting of the Corporation on Monday of last week, when the honorary freedom of the city was bestowed upon him, accompanied by the gift of a silver casket, in recognition of his services to the Municipality. Sir John, who has been a member of the Council for over 42 years, covering a period of the city's greatest development, recognized the soundness of the bargain which was effected when the gas-works were acquired. Alluding to the large capital outlay upon the principal trading undertakings, he characterized the gas concern (which was acquired for what he deemed the reasonable sum of £1,186,000) as having always been a good paying investment, and well managed.

Gas Supply of Newcastle (N.S.W.).—The accounts of the Company for the last half of 1915 showed a net profit of £9078, making a total for the twelve months of £17,983. Out of an available surplus the Directors recommended dividends at the rates per annum of 7 and £4 18s. per cent., leaving a carry forward of £4281. The paid-up capital was £263,844. At the half-yearly meeting, the Chairman (Mr. J. R. Hall) pointed out that the rate of dividend was far below that sanctioned by the Gas Act, at the price at which gas was being sold by the Company. It was quite possible that application would have to be made to the Necessary Commodities Control Commission for permission to increase the price, especially in view of the recent advance in the cost of coal. The output of gas showed a satisfactory increase. Recently the laying of more than 10 miles of mains at Stockton had been completed; and they had been connected with those on the Newcastle side by means of a submerged main across the entrance to the harbour—an arduous task. The report was adopted.

Water Supply of Newcastle and Gateshead.—In his remarks to the stockholders at the annual meeting of the Newcastle and Gateshead Water Company, the Chairman (Mr. J. C. Hamilton) said that, compared with the previous year, the revenue from all sources had increased by £12,306, while the working expenses had advanced by £4247, being at the rate of 25·85 per cent. on the gross revenue, as compared with 25·37 per cent. for the previous year. In view of the available balance at the disposal of the Company, the Directors had taken the opportunity to deal with the depreciation of meters. Meters were, of course, of a perishable nature; and although kept up and renewed out of revenue, very old meters became obsolete. They had, therefore, written-off the sum of £4000 towards a depreciation fund, which would have to be added to from time to time until the expenditure on meters was brought down to the present value, as shown by the stock sheets. The net revenue, after this deduction, amounted to £169,949, as compared with £165,890 a year ago. Additional interest, through the enhanced value of money, had had to be paid during the year on temporary loans. After providing for this and the dividends to be declared, there would be a balance to carry forward of £15,675, which was £4334 more than last year. Bearing in mind the times through which they were passing, he hoped they would consider the proposed dividend—which aggregated 8½ per cent. for the year on the original stock, and £5 19s. per cent. on the 7 per cent. maximum stock, while at the same time it had been found possible to improve the Company's financial position—highly satisfactory.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for March 22.]

Nos. 3680—4078.

Barralet, T. E.—"Thermostats for water-heaters." No. 3890.
Drake, J. W.—"Controlling draught on furnaces." No. 3947.
Drakes Limited.—See Drake. No. 3947.
Forster, J. D.—"Prepayment meters." No. 3727.
Glover, S.—"Discharging vertical retorts." No. 3731.
Hamlyn, W. R.—"Stills for tar." No. 3960.
Hault de Lassus, F. de.—"Mantles." No. 4058.
Kershaw, H.—"Inverted burners." No. 3820.
Legat, A. S.—"Gas-cookers and boiling-rings." No. 4047.
Metropolitan Gas-Meters Limited.—"Prepayment meters." No. 3727.
Metropolitan Gas-Meters Limited.—"Locks and keys." No. 3728.
Parkinson Stove Company.—See Barralet. No. 3890.
Riter-Conley Manufacturing Company.—"Producing sulphate of ammonia." No. 4000.
Roots, J. D.—"Incandescent mantle lamps." No. 3981.
Shackleton, J.—"Flame-spreaders for gas-lights." No. 3939.
West, J.—See Glover. No. 3731.

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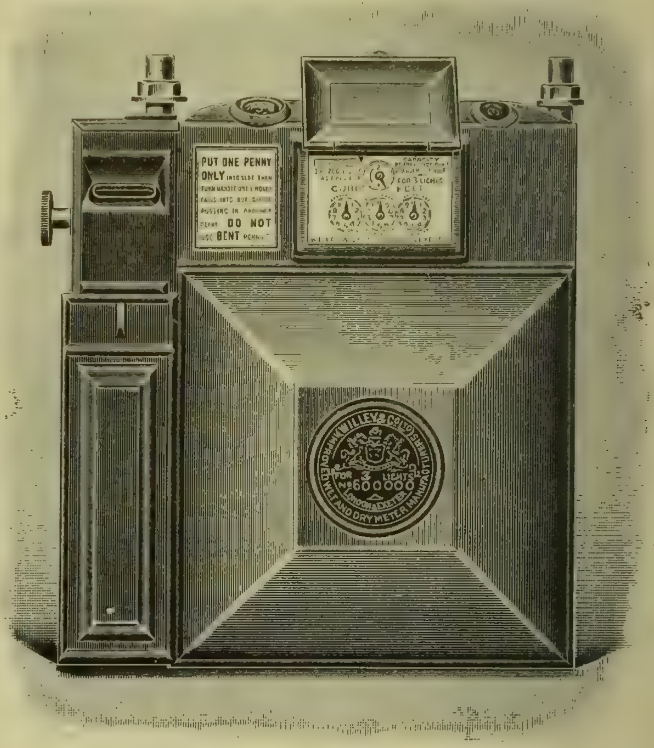

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Lurgan Gas-Works Purchase.—At a special meeting of the Lurgan Town Council, it was agreed to sign authority for the payment of £41,544 in favour of the Lurgan Gas Light and Chemical Company, Limited—being £40,000 for the purchase of the undertaking, together with an expenditure on capital account of £582, and the purchase of stores, £962.

Advance in Price Cancelled at Barnard Castle.—At the annual meeting of the Barnard Castle Gas Company, the Chairman (Mr. R. T. Richardson) presented the report, which showed an increase in the sale of gas to ordinary consumers, and a substantial gain in the revenue from residuals. The Cotherstone consumption had progressed satisfactorily; and a statement prepared by the Secretary (Mr. R. Wood) showed that the original estimate by their Consulting Engineer (the late Mr. Joseph Hepworth) had already been exceeded. A satisfactory feature was the withdrawal of a notice given in December that an advance of 2d. per 1000 cubic feet would be made in the price of gas, as from Jan. 1. The financial statement showed a balance of £1254 on the year's working. It was decided to pay a dividend for the half year at the rate of 6 per cent. per annum on the original consolidated stock and £4 5s. 8d. per cent. on the new ordinary stock, free of income-tax. A sum of £1133 is carried forward.

Ripon Gas-Works Extensions.—It is stated that the Ripon City Council have decided to drop a proposed electricity scheme, and to proceed with a scheme prepared by Mr. J. Wilfrid Dunn for the extension of the gas-works.

Gas or Electricity for Camp Lighting.—The Army Council having declined the offer of the Bridge of Allan Town Council to supply gas for the Hutment Camp at Cornton, the Clerk was instructed to appeal to Dr. W. A. Chapple, M.P., to continue his support of the proposal to use gas instead of electricity at the camp. The Secretary of the War Office now states that the Army Council have referred the question of the lighting of the camp to the General Officer, Commanding-in-Chief, Scotland, for reconsideration.

Another Increase in Price at Walton-on-Thames.—Intimation is made by the Directors of the Walton-on-Thames and Weybridge Gas Company that, owing to the enormous increase in the cost of coal, brought about by the unprecedentedly high freights, they are compelled to raise the price of gas 4d. per 1000 cubic feet as from the beginning of next quarter. This will make the charge 4s. 3d. per 1000 cubic feet, which compares with a figure of 3s. 6d. up to about a year ago, when there was an advance of 5d. per 1000 feet.

STOCK MARKET REPORT.

The state of things on the Stock Exchange underwent a noteworthy improvement last week; and the accelerated activity of markets, coupled with a very cheerful tone, quite revived the drooping spirits of members who for so long have found little to do. The public dropped their veil of hesitation, and showed themselves ready to embark not only in solid investments, but in more speculative and exciting lines. And in response to demands where the supply of stock was low, many prices advanced freely. In Government issues, the War Loan and Consols opened and closed strong. A momentary check was experienced, ascribed to the lowering by the Government of Treasury Bill rates, which might divert money into Exchequer Bonds; but this was soon cured. The much-tried Home Rails market had quite a gratifying recovery. Confident expectations regarding the future were entertained, and prices hardened daily. Americans were depressed; the Mexican trouble being a dark cloud there was no seeing through. Canadians bore up only moderately against the influence, in spite of their internal strength. In the Foreign Market, the salient feature was the steadiness of the French loan. South Africans had a good week, though latterly steadied by the inevitable realization of profits. In the Miscellaneous Market, there was much activity, and some lines were very strong—rubber and oil being conspicuous in the van. The Money Market was rather quiet on the whole, but rates in general pointed in the upward direction. Topics of interest were not numerous. The Government, having at length settled their scheme for borrowing Dollar securities with rights of purchase, made an announcement of its terms, and the same are attracting criticism. The Exchequer returns for the previous week are favourable and encouraging. The election of the new Stock Exchange Committee is regarded with satisfaction by the Anti-German Union. The Directors of the Baltic Shipping Exchange are going to deal with alien enemy members on lines similar to those of the Stock Exchange Committee. Business in the Gas Market was very quiet, and no features of interest were presented. Prices showed practically no change.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 72¾, ditto preference 74½, Portsea "C" 104, Primitiva preference $3\frac{11}{16}$. On Tuesday, Gas Light ordinary 72⅜, 72½, 72¾, 73, Imperial Continental 60¼, 60½, Portsea "C" 103½, Primitiva 2, $2\frac{1}{32}$. $2\frac{1}{16}$, 2⅛, South Metropolitan 75, 75¼, 75¾. On Wednesday, Continental Union 38½, Gas Light ordinary 72, 72¼, 72½, Imperial Continental 6c¼, Liverpool 87½, Primitiva 2⅛, ditto preference $3\frac{9}{16}$. On Thursday, Brentford "A" 84¼, 84¾, British debenture 70, Gas Light ordinary 72½, ditto debenture 59¾, 60, Imperial Continental 59½, 59¾. On Friday, Gas Light ordinary 72¼, 72½, 72¾, Primitiva $2\frac{3}{16}$. On Saturday, Commercial 4 per cent. 72, ditto 3½ per cent. 69, ditto debenture 56, Gas Light ordinary 72½, 72¾, 73, Imperial Continental 59, South Metropolitan 75½, ditto debenture 60½.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

The Darlington General Purposes Committee have decided that all men employed at the gas-works shall have the war bonus scale amended so as to provide for an increase of 1s. per week to each.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
374,000	„	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd. . . .	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water { 10 p.c. . .	29—30	5 6 8	..
333,110	10	„	7	7/-	B 7 p.c. .	15—15½	4 10 4	..
115,000	10	„	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Brentford A Consold. .	261—266	5 5 3	84¼—84¾
734,920	„	„	†11	55/-	Do. B New . .	204—209	5 5 3	..
55,000	„	„	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
221,400	„	June 11	4	4	Do. 4 p.c. Deb. .	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	„	„	8	7¾	Do. A Ord. Stk. .	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	70
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	72
560,000	„	„	5⅛	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	69
475,000	„	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	56
800 000	Stk.	„	4	4	Continental Union, Ltd.	76—79	5 1 3	38½
200 000	„	„	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	5¾	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	„	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	..
16,327,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke { 4 p.c. Ord. . .	98—102	4 15 6	72—73
2,600,000	„	„	3½	3½	3½ p.c. max. .	76—79	4 8 7	..
4,062,235	„	„	4	4	4 p.c. Con. Pref.	96—99	4 0 10	74½
4,674,850	„	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	59¾—60
130,000	„	„	10	10	10 p.c. Bonds .	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¼	Ilford A and C . . .	151—154	5 2 4	..
65,780	„	„	6⅜	5⅞	Do. B	115—118	5 8 0	..
65,500	„	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6	59—60½
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
235,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	5	Liverpool 5 p.c. Ord. { A B	211—213 146—148	4 13 11 4 14 7	} 87½
306,083	„	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne } 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 13 4	..
1,875,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅔	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7½—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	4 19 8	..
100,000	50	„	12	60/-	Do. C . .	118—121	4 19 2	103½—104
52,000	50	„	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 18 4	2—$2\frac{3}{16}$
499,960	5	June 26	5	2/6	„ 5 p.c. Pref. .	4¾—5	5 0 0	$3\frac{9}{16}$—$3\frac{11}{16}$
521,600	100	June 2	4	4	„ 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	4	„ „ „ 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	„	„	10	10	Do. B	222—224	4 9 8	..
523,500	„	„	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75—75¾
1,895,445	„	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60½
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	„	„	5	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
187,558	„	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District { A 5 p.c. .	135—138	5 8 8	..
782,275	„	„	6	6	B 3½ p.c. .	115—117	5 2 7	..
181,255	„	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	„	„	6⅞	63/9	„ B 3½ p.c.	129—134	5 2 7	..
108,075	„	„	5/17/3	55/1½	„ C 3½ p.c.	110—115	5 2 0	..
852,000	„	„	6⅛	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	„	„	6⅝	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	„	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

* Ex. Div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

Plymouth Gas Bill.—There is, it seems, some likelihood of this Bill being opposed by the Corporation on third reading—at all events, after a conference between the parties last Thursday, the matter is still under consideration.

Belfast Water Undertaking.—Mr. G. Bryan (the Irish Local Government Board Auditor), in his report on the accounts of the Belfast Water Commissioners, states that for the past financial year the income on revenue account was £127,363, and the expenditure (including £24,631 transferred to sinking fund) £115,051, showing a credit on the year's working of £8312, which, added to the balance of £30,930 at the beginning of the year, brought the balance to credit of this account up to £39,242. Of this the Commissioners have transferred £32,000 to the reserve fund, bringing the fund up to £72,000. The allocation to the sinking fund brought the total accumulation up to £356,586.

At the last meeting of the Westminster City Council, the Works Committee reported that they recently agreed to pay one-half the cost incurred by the Gas Light and Coke Company in obscuring lamps in connection with the reduction of public lighting. This arrangement was for six months only; and fresh arrangements being necessary, they had agreed to make payments at the same rates—3d. each for small, and 6d. each for large lamps—for all lamps obscured by the Gas Company on orders from the Council.

A strong smell of gas led to the discovery of Thomas M'Laren at a house in Bradford, lying fully dressed and dead on his bed. The gas had been left turned on, but not lit.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "Journal" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Manager. Brampton Gas-Works.
Manager. Godstone Gas-Works.
Superintendent. Aldershot Gas, Water, and District Lighting Company.
Foreman. Bombay Gas Company. Applications to London Office (Moorgate Station Chambers) by April 4.
Collector Representative. Dorking Gas Company. Applications by April 3.
Clerks (Male or Female). Aldershot Gas, Water, and District Lighting Company.

Appointments, &c., Vacant (*continued*).

Man for Cooker Campaign (Brazil). J. G. White and Co., Cloak Lane, E.C.

Appointments, &c., Wanted.

Representative, &c. Z. L., 743, c/o Deacon's.
Representative. T. Ousey, Manchester.

Plant, &c. (Second Hand), for Sale.

Engines and Exhausters. Preston Gas Company.

TENDERS FOR

Coal.

Dronfield Gas Company. Tenders by April 10.
Liverpool Gas Company. Tenders by April 7.
Macclesfield Gas Department. Tenders by April 15.
Northwich Gas Company. Tenders by April 8.

Stoking Machinery.

Halifax Corporation. Tenders by April 3.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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"Journal of Gas Lighting, Water Supply, and Sanitary Improvement." March 21, 1916. Registered as a Newspaper.

JOURNAL OF GAS LIGHTING AND WATER SUPPLY

Vol. CXXXIII. No. 2758.] LONDON, MARCH 21, 1916. [68th Year. Price 6d.

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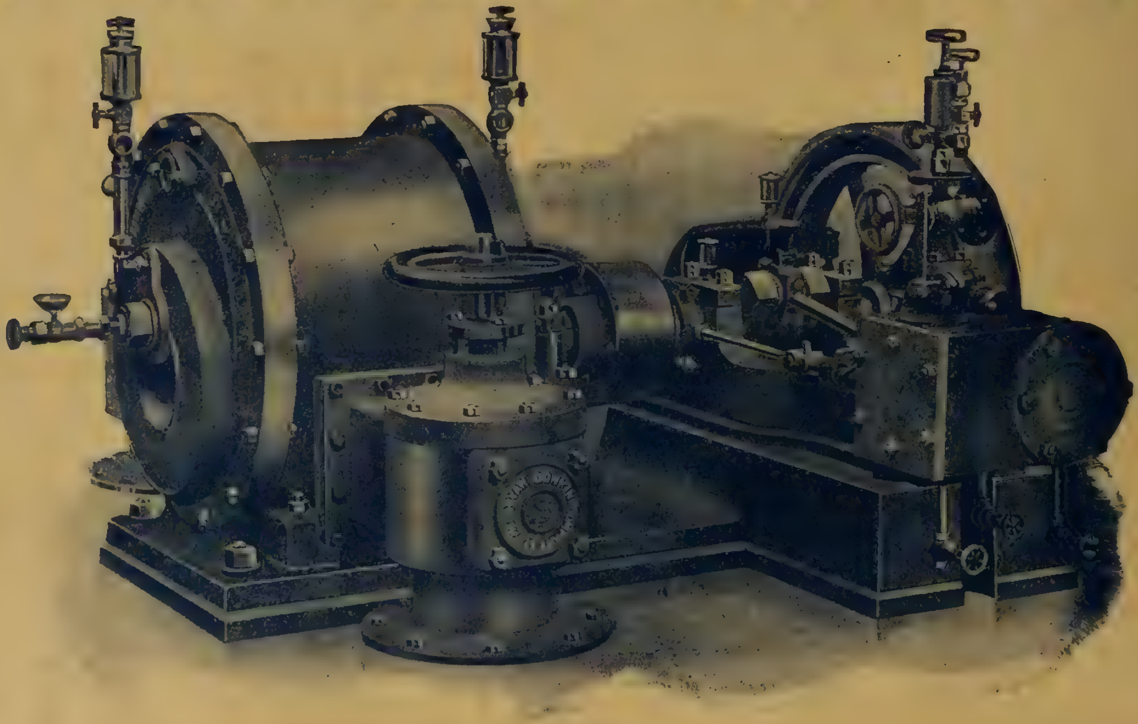

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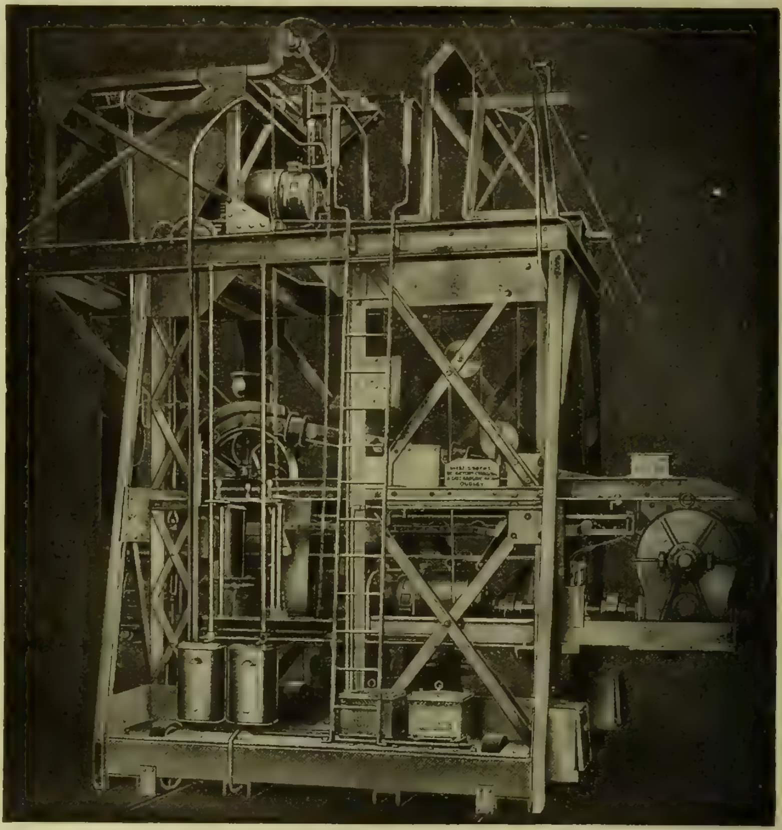

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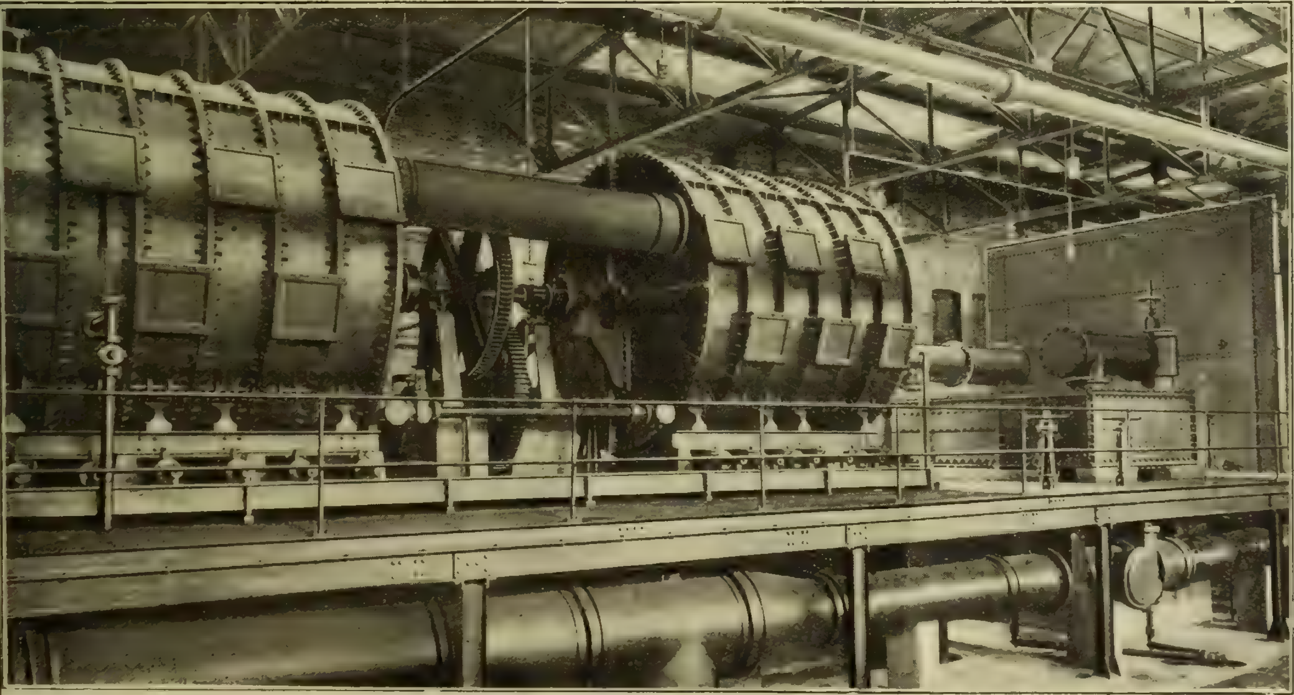

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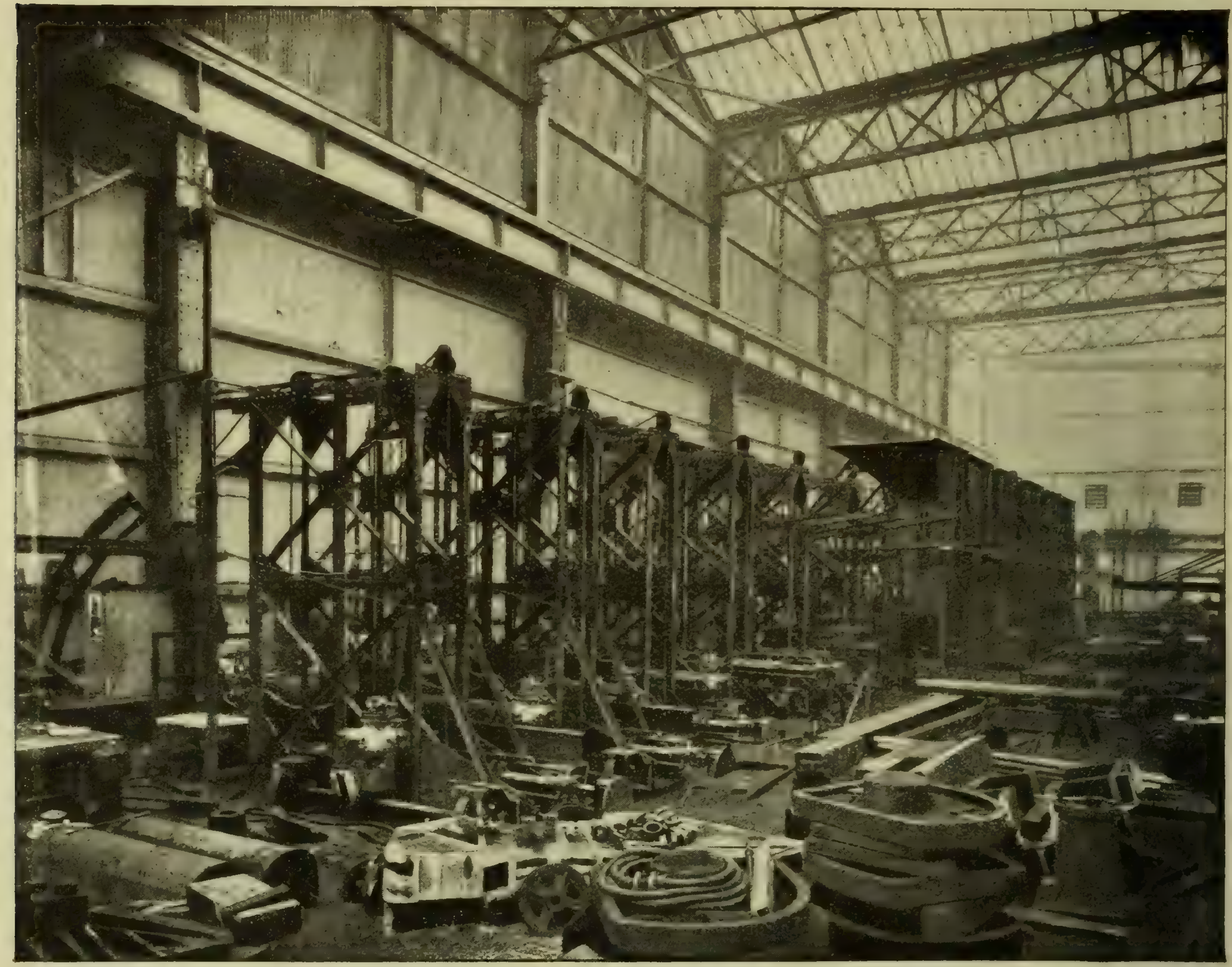

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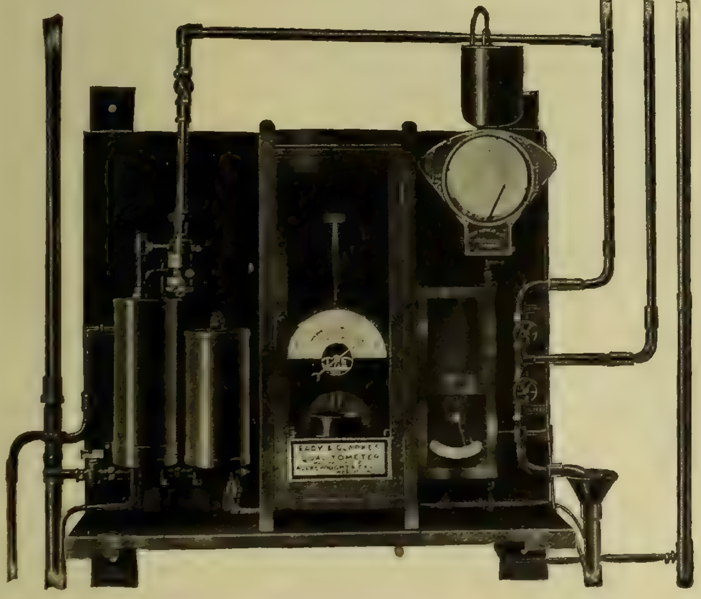

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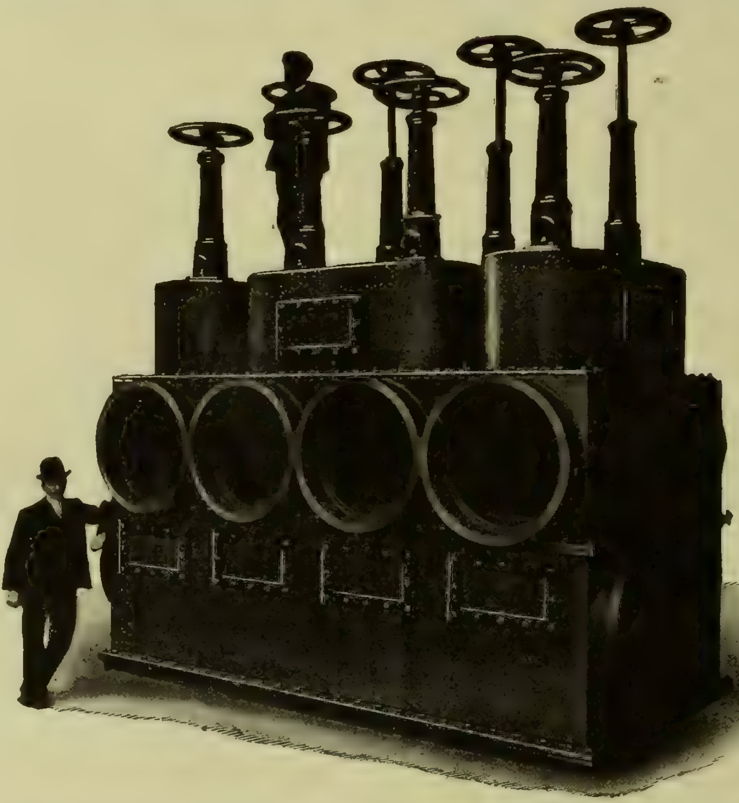

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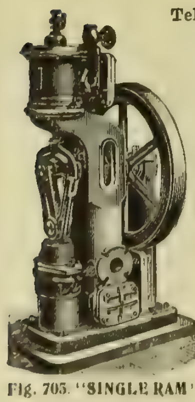

Fig. 705. "SINGLE RAM" STEAM-PUMP.

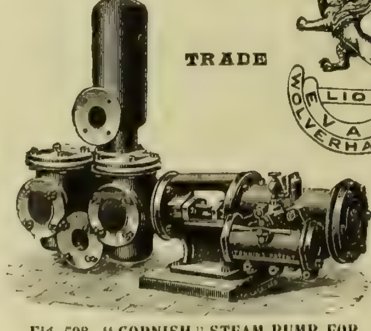

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

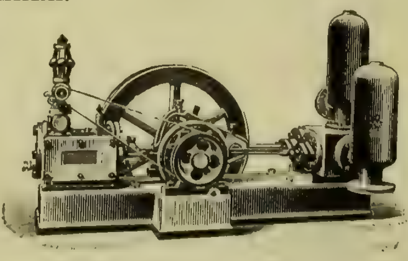

Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

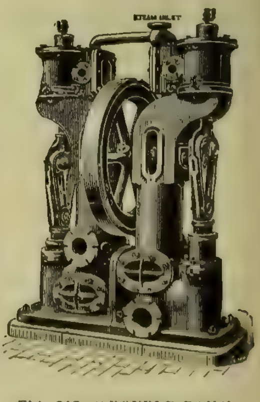

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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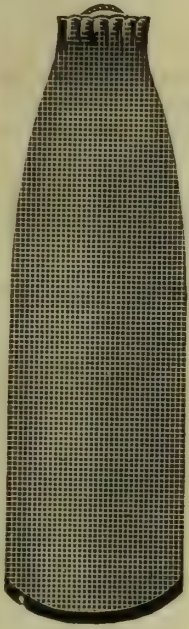

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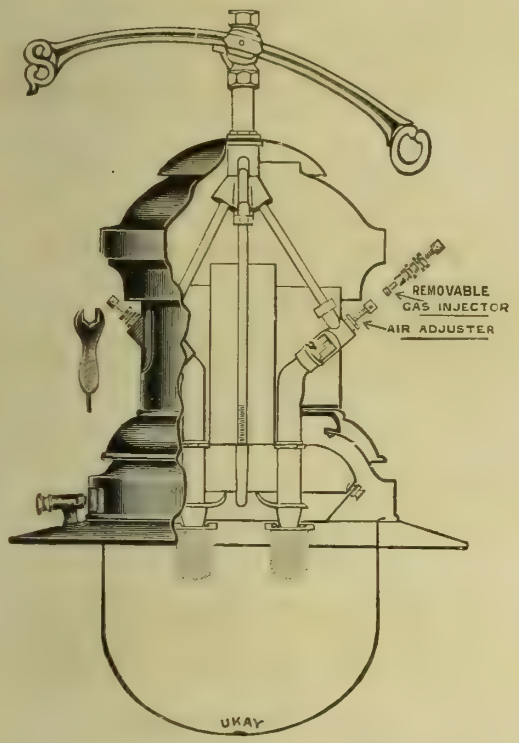

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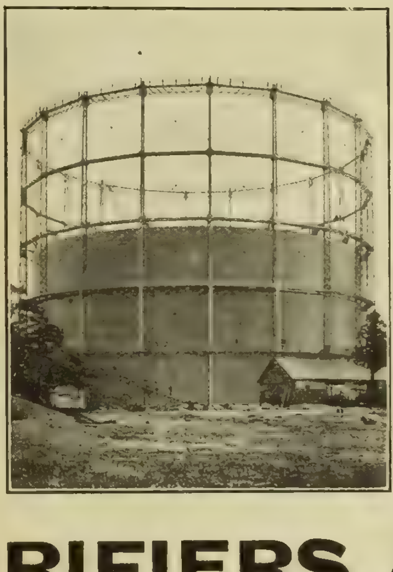

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Rotterdam (3)	750,000
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Rotterdam (5)	600,000
Rotterdam (6)	2,000,000
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Shanghai (3)	1,600,000
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Southampton	800,000
Southampton (2)	500,000
Southampton (3)	600,000
Southampton (4)	100,000
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Stettin	880,000
Stockholm	1,500,000
Stockholm (2)	1,750,000
Stockport	600,000
Stockport (2)	600,000
Stockport (3)	400,000
Stockport (4)	400,000
Stockton	500,000
Stockton (2)	250,000
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Stourbridge (2)	500,000
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Swansea (2)	1,000,000
Swansea (3)	450,000
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Swindon (2)	450,000
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Sydney (2)	1,000,000
Sydney (3)	1,000,000
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Tottenham (2)	750,000
Tottenham (3)	350,000
Tottenham (4)	1,000,000
Tottenham (5)	1,000,000
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Wasmuel	500,000
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West Ham (2)	800,000
Weston-Mare	350,000
Weston-Mare (2)	350,000
Wexford	100,000
Wiesbaden	850,000
Winchester	225,000
Winchester (2)	125,000
Woking	400,000
Wolverhampton	1,500,000
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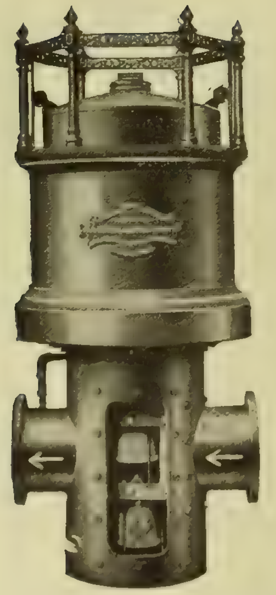

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THE Corporation of Leigh invite Applications for the Position of GAS AND WATER ENGINEER for the Borough.

Salary, £350 per Annum, increasing by annual increments of £50 (subject to approved service) to a maximum of £450.

Candidates, in addition to the Ordinary Duties of Gas and Water Engineer, must be Competent to Design and Supervise the Construction of New Works, Additions, or Extensions to Existing Works.

The person Appointed will be required to Devote the Whole of his Time to the Duties of the Office, and Reside within the Borough.

Applications, accompanied by *copies* of not more than three Testimonials of recent date, and endorsed "Gas and Water Engineer," must be Delivered to me not later than the 23rd inst.

Canvassing members of the Council will be a Disqualification.

W. H. COWBURN,
Town Clerk.

Town Hall, Leigh (Lancs.),
March 11, 1916.

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APPLICATIONS are invited, from Men ineligible for National Service, to fill the Position of SHOWROOM MANAGER, COLLECTOR and SUPERVISOR OF SERVICES AND FITTINGS for the Duration of the War. Candidates must be capable of Advising on all Matters of Gas Supply, Controlling Workmen, and Keeping all Books relating to Distribution of Gas and Collection of Consumers' Accounts.

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TO CONTRACTORS.

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Further Information may be obtained from Mr. W. G. Thomas, Surveyor, Town Hall, Mountain Ash.

Tenders, endorsed "Gas-Retorts," to be sent to me so that they may be received not later than 10 o'clock in the forenoon of Tuesday, the 4th day of April, 1916.

The Council do not bind themselves to accept the lowest or any Tender.

By order.
A. PINCOMBE,
Clerk to the Council.

Town Hall, Mountain Ash,
March 14, 1916.

SCUNTHORPE URBAN DISTRICT COUNCIL.

THE Gas Committee of the above Council invite TENDERS for the Supply of MATERIAL and the RESETTING of Eight RETORTS at the Council's Gas-Works.

Particulars can be obtained from Mr. J. W. Turner, Manager, Gas-Works, Scunthorpe, Lincs.

Sealed Tenders, endorsed "Retort Settings," must be sent to H. M. Hett, Esq., Clerk to the Council, 108, High Street, Scunthorpe, Lincs., not later than 6 p.m , April 10, 1916.

The lowest or any Tender not necessarily accepted.

J. W. TURNER,
Manager.

Gas-Works, Scunthorpe,
Lincs.

THE Warrington Corporation Gas Department are prepared to receive TENDERS for:

(*a*) 120 Tons of OXIDE OF IRON for Gas Purification, and

(*b*) AMMONIACAL LIQUOR CONCENTRATING PLANT,

not later than 9 a.m., March 27, 1916.

Further Particulars on Application to the undersigned.

W. S. HADDOCK,
General Manager.

Gas Offices,
Warrington, March 15, 1916.

COUNTY BOROUGH OF SALFORD.

(GAS DEPARTMENT.)

TENDERS are invited for the Supply of OXIDE OF IRON.

Full Particulars may be obtained on Application to Mr. WILLIAM W. WOODWARD, Engineer, Gas Offices, Bloom Street, SALFORD.

ASHFORD (KENT) URBAN DISTRICT COUNCIL.

THE above Council invite Tenders for the Supply of 45 000 Gallons of GAS OIL between now and March 31, 1917.

Endorsed sealed Tenders must be sent to the Clerk to the Council, 11, Bank Street, Ashford, on or before March 29.

Further Particulars can be obtained from the undersigned, to whom a Sample of the Oil quoted for must be submitted.

HERBERT R. TURNER,
Engineer and Manager.

BOROUGH OF LEIGH.

(GAS DEPARTMENT.)

THE Gas and Water Committee of the above Corporation invite TENDERS for the Removal of the Surplus TAR produced at their Works during the Year ending March 31, 1917.

Approximate quantity, 900 Tons.

Forms of Tender and any other Information may be had on Application from the undersigned, to whom all inquiries must be addressed.

Sealed Tenders, endorsed "Tender for Tar," must be Delivered to W. H. Cowburn, Esq , Town Clerk, Town Hall, Leigh, Lancs., on or before Twelve o'clock noon on Thursday, the 23rd day of March, 1916.

The Corporation do not bind themselves to accept the highest or any Tender.

JAMES GIBSON,
Engineer and Manager.

Gas and Water Offices,
Leigh, Lancs., March 15, 1916.

FORFAR GAS CORPORATION.

THE Corporation are prepared to receive TENDERS for the Supply of GAS COAL and NUTS for the Year from May 16, 1916, to May 15, 1917.

Conditions and Forms of Tender may be obtained on Application to the Engineer and Manager.

Tenders, endorsed "Tender for Gas Coals," to be addressed to Mr. J. S. Gordon, Deputy Clerk to the Gas Corporation, The Cross, Forfar, by Friday, April 7, 1916.

T. W. HARPER,
Engineer and Manager.

TAUNTON GASLIGHT AND COKE COMPANY.

THE Directors invite Tenders for the Supply of COAL over One Year from the 1st of July next.

Particulars are obtainable from the Secretary, to whom sealed Tenders should be Delivered not later than First Post on the 28th inst.

By order,
A. EDWARDS,
Secretary and Manager.

March 18, 1916.

MACCLESFIELD CORPORATION.

THE Gas Committee of the Corporation of Macclesfield are prepared to receive TENDERS for the Supply of 15,000 Tons of Screened GAS COAL and GAS NUTS Delivered f.o.r. Macclesfield.

Any further Particulars can be obtained from the undersigned.

Tenders, endorsed "Coal," to be addressed to the Chairman of the Gas Committee, and to be sent not later than April 15, 1916.

The Committee do not bind themselves to accept the lowest or any Tender.

J. E. BLUNDELL,
Engineer and Manager.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Chief Office of the Company, No. 11, George Yard, Lombard Street, in the City of London, on Wednesday, the 29th day of March, at Twelve o'clock precisely, to Transact the usual Business, and to declare a Dividend for the Half Year ended the 31st of December last.

NOTICE IS HEREBY ALSO GIVEN that the TRANSFER BOOKS of the Company WILL BE CLOSED on the 18th inst., and RE-OPENED on the 30th inst.

By order of the Court of Directors,
A. W. BROOKES,
Secretary.

Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.,
March 9, 1916.

PATENTS.—Handbook of Patent Law, by W. P. THOMPSON, F.C.S., M.I.Mech.E., C.P.A., International Patent Agent, 6, Lord Street, Liverpool, and Bradford and London. 16th Edition 1915, 242 pages. 2s. 6d. Post free. English Portion, 6d. "A useful guide to inventors. The subject is treated in a simple and concise manner."—JOURNAL OF GAS LIGHTING.

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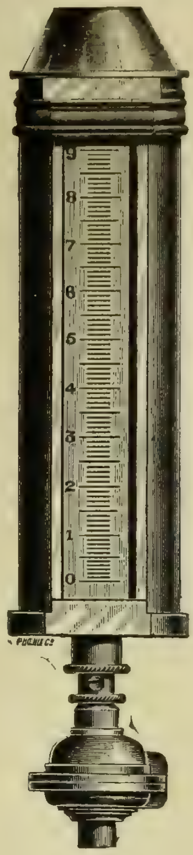

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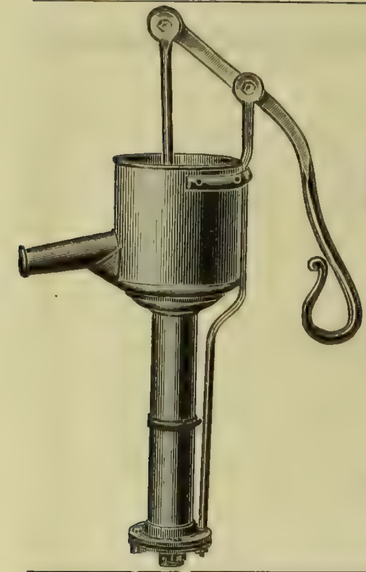

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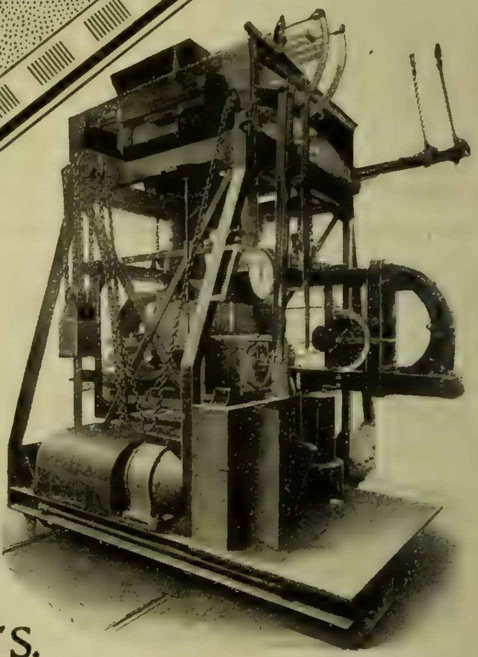

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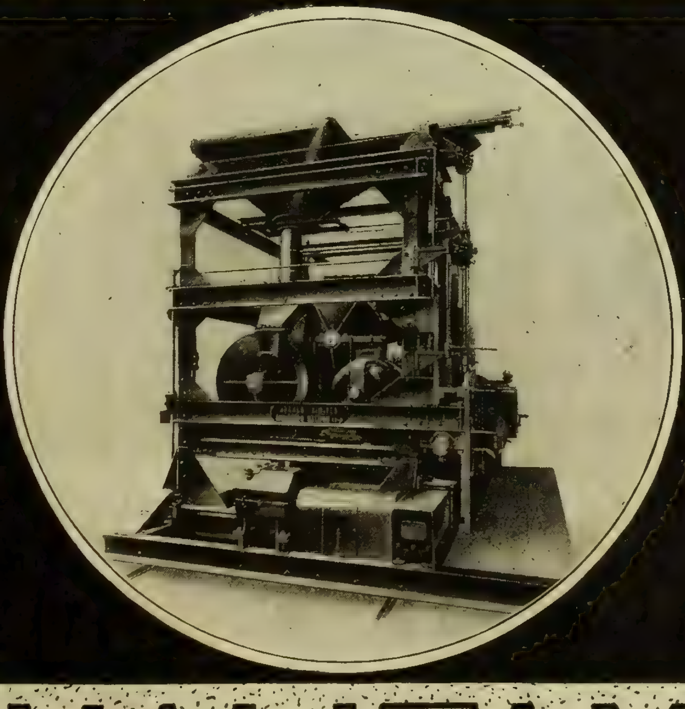

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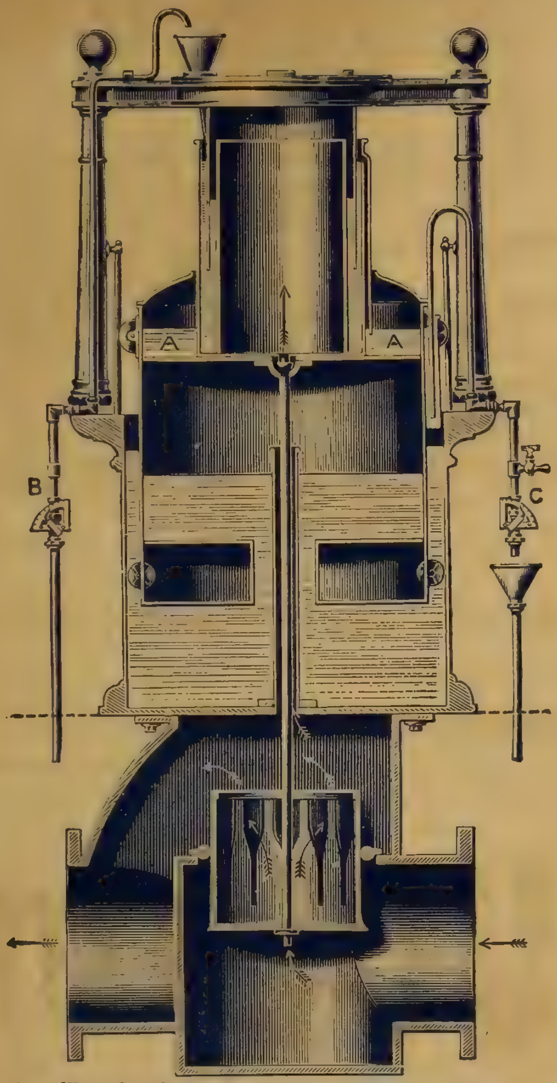

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